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HIGGINS, L. G., M.A., F.R.C.S., F.R.E.S. A descriptive catalogue of the genus *Mellicta* Billberg (LEPIDOPTERA : NYMPHALIDAE) and its species, with supplementary notes on the genera *Melitaea* and *Euphydryas* . . . . . 1–131, 2 plates, 4 maps, 88 figs.

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TRANSACTIONS
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VOL. 106. 1955.

A DESCRIPTIVE CATALOGUE OF THE GENUS *MELLICTA* BILLBERG (LEPIDOPTERA : NYMPHALIDAE) AND ITS SPECIES, WITH SUPPLEMENTARY NOTES ON THE GENERA *MELITAEA* AND *EUPHYDRYAS*.

By L. G. HIGGINS, M. A., F.R.C.S., F.R.E.S.

WITH 2 PLATES, 4 MAPS AND 88 TEXT-FIGURES.

Manuscript received 29th January, 1954.

(Read 6th October, 1954)

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1. INTRODUCTION AND ACKNOWLEDGMENTS.

Mellicta athalia (Rottemburg) and its allies present a small group of butterflies of exceptional interest from several points of view. The insects are Palaearctic in distribution and inhabit characteristically the temperate and alpine zones. Like all the Melitaeini, they are strictly localized to colonies, but many have extensive distributions and are of great zoogeographical interest. The concentration of seven distinct species in western Europe cannot fail to appeal to European entomologists. In this area also there occur the northern and southern forms of *M. athalia* (Rott.), with marked anatomical differences, which provide a classical example of subspecific differentiation. Another feature, quite uncommon in Nymphaline butterflies, appears in the uniformity through the group of the standard wing pattern, which shows so little specific differentiation that in some cases identification necessitates examination of the male genitalia, where good specific characters are found. This leads at times to problems of nomenclature, as it may be difficult, or even impossible, to determine the specific identity of forms described before the importance of the genitalia was understood. The loss or disappearance of the collections and critical material of

the older authors adds further complications to the task of placing certain names. Fortunately the Staudinger collections and much of the material used by Seitz is still available for examination, but a few names introduced by Ménétriés about the middle of the last century have proved difficult. Whenever possible, unless there are strong grounds for a change, I believe it is best to accept the orthodox application of names in general use, and in nearly all cases the established determinations have proved acceptable, although it may be necessary to relax the rigid standards that would be demanded from modern authors. In all doubtful cases I have tried to explain my reasons for accepting the names and a special effort has been made to trace the whereabouts of holotypes and to examine them whenever possible. A few cases, in which the correct application of a name seems to me impossible to make, I have recorded as *nomina dubia* on page 109. Among these I have been obliged to place the name *helvetica* Rühl, 1888, which has been accepted for several years as correctly referred to the south-western subspecies of *athalia* Rott. Very little investigation is needed to show the difficulty in accepting such an attribution (*see* p. 111). Instead I have been obliged to introduce the unfamiliar name *celadussa* Fruhstorfer, 1910, which is ten years earlier than Reverdin's *pseudathalia*, under which name the subspecific distinctions were first established. It is unfortunate that there seems to be no escape from this rigid application of the Law of Priority. In several species the nomenclature is further complicated by extreme sensitivity to environment with consequent modification in size and colour. Many such modifications have been named as subspecies and in the cases of *athalia* (Rott.) and *aurelia* Nickerl the number of named forms is so great that the recognition of important trends of variation is obscured by a multitude of names. It has become increasingly apparent that such colour-forms (*formae tempestatis*) cannot be treated as a subspecies without changing the present conception of specific and subspecific rank. A new category is required for these forms, now referred to as modifications, and I have attempted to introduce a somewhat different approach to the problem of infra-subspecific variation on the lines indicated by Julian Huxley (1940, 1942), whose suggestions cover the special problems met with in *Mellicta* in a perfectly satisfactory way.

With so much to interest and attract, it is only natural that the group has received much attention. An early effort to clarify specific difficulties was made by Wheeler in a long series of papers (1908–11, *Entomologist* **20–23**). No information is given about the genitalia and there are many errors in consequence but there are interesting remarks on the reaction of *athalia* (Rott.) to different climates and other information. Little work of real value could be done without making use of the male genitalia as a check to specific determination. The first paper on modern lines was published by Dampf (1910, *Iris* : **23** (Beiheft)). He illustrated four species which he called *deione* (Geyer), *athalia* (Rott.), *aurelia* (Nickerl) and *parthenie* (Borkhausen) (this actually = *varia* Meyer-Dür). Three years later another paper appeared by Suschkin on the same lines, which deserves the highest praise (1913, *Z. wiss. InsektBiol.* **9** : 169), and included well-drawn figures and accurate identifications of many species, including *britomartis* Assmann. In this paper Suschkin frequently figured the aedeagus, an organ that has been ignored by many workers, but which, in fact, often holds the secret of specific identity. A small paper by Sheldon in 1916 (*Ent.*

Rec. **28** : 261), illustrated by photographic plates, first proved the specific identity of *M. varia* M.-D. Not long after, in 1920 and 1922, Reverdin began to work on this group and immediately discovered the startling differences between the genitalia of the northern and south-western forms of *athalia*. One of his figures, wrongly identified at the time of publication, led to the recognition of *britomartis* as a specific unit hitherto unrecognised in western Europe. Now that the way was clear, other papers soon followed by Verity and especially by Rocci, whose description of the Italian *britomartis* under the name *melathalia* is admirable. Close analysis of the well-known colour changes was undertaken by Fruhstorfer in a long series of papers beginning in 1910 and continuing until 1917. This work was continued by Verity in a number of articles which appeared from 1919 to 1932, many of them in the *Entomologists' Record*, and finally this author produced a monograph of the group, edited by Francis Hemming, which was published in these *Transactions* at the end of 1940. This work is profusely illustrated by photographic plates, including many figures of holotypes, and it is indeed a basic and essential book of reference to all workers in this group, representing great labour and achievement in collecting references to all recently described forms. Although I cannot agree with Dr. Verity on certain questions of nomenclature and taxonomy, I have made the fullest use of this monograph and include many references to the excellent figures. In this way it has been possible to avoid producing new plates, the cost of which today would be difficult to meet. I have thought it necessary to include only the text-figures of genitalia. These are line drawings, all on the same scale. In my opinion these drawings are much more satisfactory than photographs, which cannot be made in this group without compression and serious distortion of the parts. Even more recently there have appeared two papers of great interest. J. Bourgogne (1953) has published the results of his researches into the extent and position of the transitional zone between *M. athalia athalia* and *M. athalia celadussa* Fruhstorfer (*pseudathalia* Reverdin) in France. In the scope of patient investigation and the care and precision of analysis, this paper far surpasses anything of the kind that has been done before. Secondly, E. Urbahn (1952) has given an account, from his own first-hand observations, of the early stages of the three species *athalia*, *aurelia* and *britomartis*. In my opinion this small and unpretentious paper is the most important contribution to the study of these butterflies since the appearance of Suschkin's monograph in 1913. It fills in the gaps in our knowledge just where they were most obvious and in a few pages allows full understanding of the writings a century ago of such authors as Assmann and Prittwitz, many of which have proved truly incomprehensible because just these simple facts were forgotten.

Postscript.

While these pages were in the press, I received from Herr H. Beuret a separate of a most interesting paper he had published earlier this year on *M. britomartis* and *menestriesi* Car. (1954, *Mitt. ent. Ges. Basel* (N.F.) **4** : 73–88). In this paper the distinctions between the species *aurelia* Nick., *britomartis* Assm. and *menetriesi* Caradja are most clearly shown by drawings of the genitalia, including figures of the aedeagus of all species. The forms *menetriesi* and *centralasiae* Wnu. are dealt with as a single species, which may well be

correct (*see* p. 86). Beuret also points out some of the errors in Verity's monograph, including the figure attributed to *athalia britanna*, which is certainly from a specimen of *britomartis*, and the figures of " iberanana Gen. 2 " (Nos. 28, 29 and 270) which should be referred to *deione* Geyer. I understand that Dr. Beuret intends to publish other papers on the group in the near future, and in the same periodical.

ACKNOWLEDGMENTS.

I have to acknowledge the help of many friends who have been good enough to send valuable specimens for inspection and dissection. Dr. Walther Forster has sent specimens from Munich ; Dr. Elli Franz from the Senckenberg Museum and Prof. Dr. Hering series from the Staudinger collection, now at Berlin. Special recognition is due to the authorities of the British Museum (Natural History) who have allowed me the use of the collections at London and Tring, and without whose permission it would have been impossible to contemplate a revision of this group. Lastly I have to acknowledge the interest and encouragement I have received from Mr. N. D. Riley, for his active help in reading typescript, for useful criticism and suggestions, and assistance in many ways.

2. THE GENUS **MELLICTA** BILLBERG, 1820.

Mellicta Billberg 1820, *Enumeratio Insectorum* : 77.
Type species, *Papilio athalia* Rottemburg, fixed by Moore, 1901, *Butterflies of India* 5 : 2.
Athaliaeformia Verity, 1950, *Le Farfalle diurne d'Italia* 4 : 157.

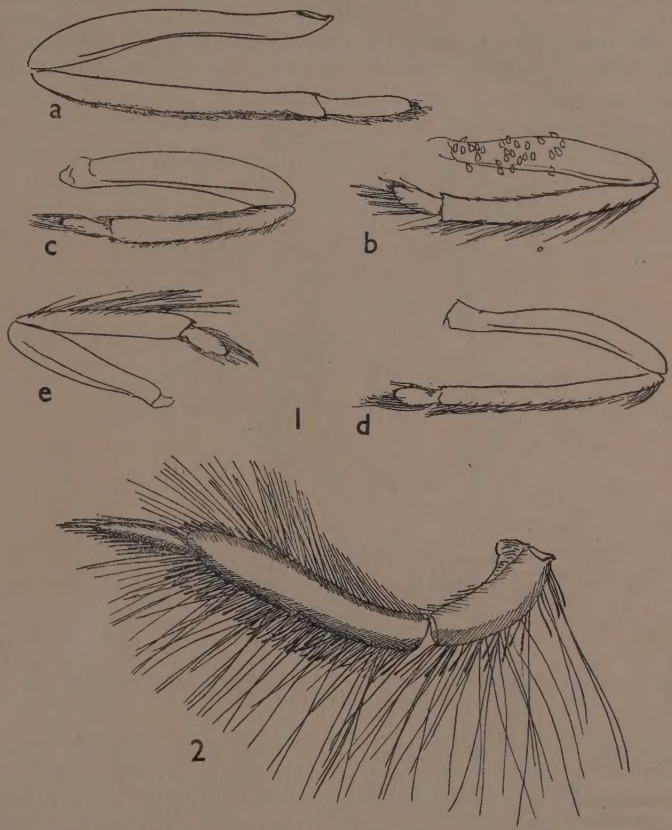
Verity (1950) did not specify a type species for his genus *Athaliaeformia*. As, in my opinion the introduction of this name is quite unnecessary I select as its type species *Papilio athalia* Rottemburg, 1775, thus making *Athaliaeformia* an objective synonym of *Mellicta* Billberg, 1820. Barnes and McDunnough, 1916, when selecting *Papilio cinxia* Linnaeus, 1758, as type species of *Mellicta*, appear to have overlooked the earlier fixation by Moore.

Some explanation is needed for the separation of this group from *Melitaea* and, in consequence, for the introduction of an unfamiliar generic name. A consideration of the characters of these insects will show that no other course is possible. The genus forms a perfectly homogeneous group of which the units can be recognised at a glance. In particular the characters of the genitalia are quite distinctive in both sexes without any approach to the forms found in *Melitaea*, i.e. no intermediate forms are known. The zoogeographic relationships are also very different. While *Mellicta* shows species concentrations in temperate climates in the east and west of the Region, *Melitaea* appears most abundantly in warm districts and the specific concentrations occur in Central Asia, in the mountains of Samarcand, in the Pamirs, in Persia and in Syria, in latitudes far south of the habitat of *Mellicta*. Such marked contrast in distribution must be an indication of very different evolutionary background and retention of the two groups in a single genus can lead only to confusion.

Generic Characters.

The genus is composed of butterflies of small or moderate size. The palpi are slightly ascending or nearly horizontal, the terminal joint long and the whole

organ quite slender (fig. 2). This feature was noticed by Stephens as long ago as 1828 and led him to place *athalia* in a special group apart from the other Melitaeine butterflies, *cinxia* (L.) and *aurinia* Rottemburg. In the male the fore leg, and expecially the tarsus, in most species, is so greatly reduced as to be almost vestigial (fig. 1*a–e*). The wing-pattern is very uniform throughout the group. On the upper surface the ground-colour is yellowish or reddish-orange, the nervures outlined with black scales and crossed by a series of black



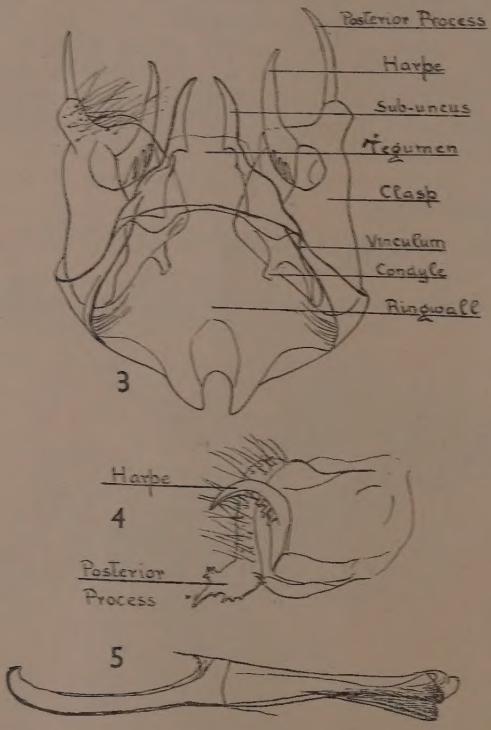
FIGS. 1–2.—*Mellicta* (1) Male fore-legs. *a*, *athalia* Rott. ; *b*, *varia* M.-D. ; *c*, *latefascia* Fixsen ; *d*, *athalia* Rott. ; *e*, *parthenoides* Kef. (2) *aurelia* Nick. Palpus.

macules to make a lattice-work pattern. On the under surface of the fore wing the markings are similar but less complete ; on the hind wing the pattern changes and the ground-colour is pale yellow or white with a prominent darker submarginal fascia containing orange lunules, a shorter, broken dark median fascia and 3 or 4 orange macules at the base of the wing. The wing-pattern is so constant generically and so variable individually that reliable specific determination cannot be made without examination of the male genitalia. In

many cases and with much experience a fair degree of accuracy can be attained, but nobody who has worked with this group would undertake the naming of species upon external characters alone, and in the case of the small *aurelia*-like forms of eastern Asia it is necessary to dissect every specimen. On this account I have made great efforts to trace the type of all names used and to give the basis for all attributions in those cases, unfortunately quite numerous, in which the type has disappeared or in which no type has been specified.

Genitalia.

The genitalia (fig. 3–6) show good generic and specific features. In the male the parts are strongly chitinised and very rigid. The tegumen is wider



FIGS. 3–5.—(3) *M. athalia* (Rott.). Male genitalia, dorsal view, aedeagus removed. (4) *M. britomartis amurensis* Stgr. Clasp, lateral (medial) view. (5) *M. britomartis amurensis* Stgr. Aedeagus, lateral view.

than in *Melitaea* and in many species a pair of subuncal processes extend backwards from the lateral margins. The degree of development of these processes is often variable among different specimens from the same locality and, although conspicuous, their taxonomic value must be judged with caution. The tegumen is connected by slender vinculae with the wide and solid ring-wall. The clasps (fig. 4) are broad, oval or nearly quadrilateral, with a prominent tuberculated

area, and the posterior process in lateral view is seen to carry complicated teeth and spines. These may show great variation between different individuals, but the general shape of the process is often a valuable specific distinction. Arising from the lower margin of the clasp there is a strong harpe directed posteriorly, which tapers gradually to a point and carries prominent teeth along its inferior border. The position and shape of this organ is so constant throughout the genus that it is of little or no value in specific determination. The aedeagus (fig. 5) is straight or slightly curved and provides most important specific features. In lateral view there can be seen the ostium-keel, a structure that scarcely appears in *Melitaea*. The morula is developed in some species, often more or less hidden by the ample ostium-folds. These structures show little individual variation and provide such excellent specific characters that I look upon the aedeagus as the most important feature of the male genitalia from a taxonomic point of view. The female genitalia are equally characteristic.

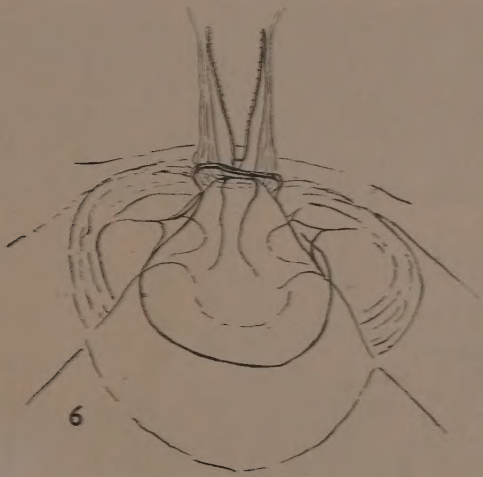


FIG. 6.—Female genital plate and bacillus. *Mellicta athalia*. Kent, England.

The genital plate (fig. 6) is relatively very large, covering a wide area of the ninth and tenth abdominal segments. The bacillus is double, arising from a low pit that is excavated around the ostium bursae and which expands on each side to form the auricles. The round bursa, supported by the bacillus, is tensely distended with pigmented material and forms a conspicuous feature, even in old specimens. The whole structure is full of character with the generic features strongly marked.

Early Stages.

The early stages of *athalia*, *aurelia* and *britomartis* have been described by Urbahn (1952) in admirable detail. Inadequate descriptions are to be found also of the larvae of *varia*, *parthenoides* Keferstein and *deione* (Geyer). In all cases the larval ground-colour is dark brown or black, scattered with white points and with yellowish or grey (?) spines. The eggs of the three species described

by Urbahn are all somewhat oval, about 0·6 mm. in height, pale shining yellow when first laid, with 18–20 longitudinal ribs arranged around the narrow micropyle. As a rule they are laid in batches upon or beneath the leaves or upon the flowers of the food-plants, which include *Plantago* ("Spitzwegerich"), *Veronica*, *Melampyrum* and *Linaria*. The young larvae live together in a web as in all allied genera, and pass the winter in this state. In the early spring the party breaks up and the larvae live singly and feed up rapidly to emerge as imagines in the late spring or early summer. In several species inhabiting warm countries a second brood appears in the late summer, and in other species (e.g. *athalia*) the second brood appears only in the southern districts of the distribution area. The butterflies are essentially localised and the colonies are frequently restricted. There is no evidence of migratory movement in the group and it is rare to find single specimens straying from their headquarters.

Distribution.

These butterflies are distributed over the cold and temperate areas of the Palaearctic Region. At the western and eastern limits of their range, in northern Africa and in Japan, they extend slightly south of the 40th degree of north latitude, but this is exceptional and their true home is in cooler regions. There are several alpine forms and one species at least is at home within the Arctic Circle. The entire group, consisting probably of 13 species, is evenly distributed between Europe and Asia, with a striking assembly of forms in the extreme

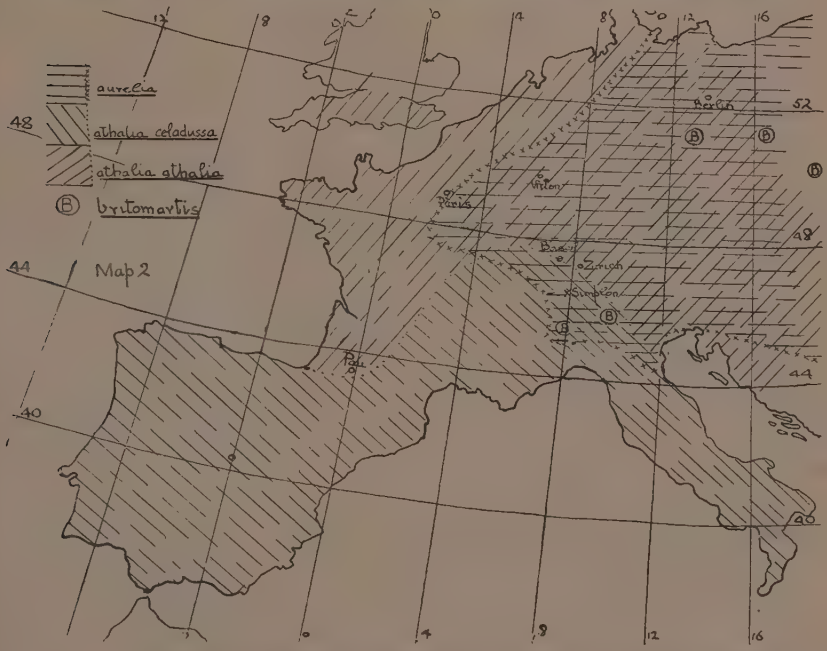
MAP 1.—The genus *Mellicta*. Distribution of Western European species, including *athalia celadussa* Fruhst.

western and eastern districts of the region, while a single form appears peculiar to the Caucasus. At least it may be said that this position can be accepted as accurate as far as our knowledge goes to-day, but it must not be forgotten that there is scarcely any material in western Europe from Russia and western Siberia with the Urals, and it is only possible to make a provisional indication of the distributional pattern.

The following seven species inhabit western Europe. (Maps 1 and 2.)

1. *Mellicta athalia* Rottemburg.
2. *M. deione* Geyer.
3. *M. parthenoides* Keferstein.
4. *M. aurelia* Nickerl.
5. *M. varia* Meyer-Dür.
6. *M. asteria* Freyer.
7. *M. britomartis* Assmann.

In addition there is a well-marked subspecies, *M. athalia celadussa* Fruhstorfer, with strongly characterised male genitalia, that appears only in the south-west of the area. The first five species all occur in France, six are found in Switzerland, three extend into southern Germany, and three into Spain and Portugal, while one reaches northern Africa. The whole group, except possibly *asteria*, can be found in northern Italy, where *britomartis* is known from several localised colonies. The species *aurelia*, *deione* and *asteria* with the subspecies *athalia celadussa* Fruhstorfer do not develop subuncal processes below the tegumen. These processes appear in all members of the eastern Siberian group and their absence must be judged a western character. The two forms *varia* and *parthenoides* show slightly unusual features in the male genitalia and they



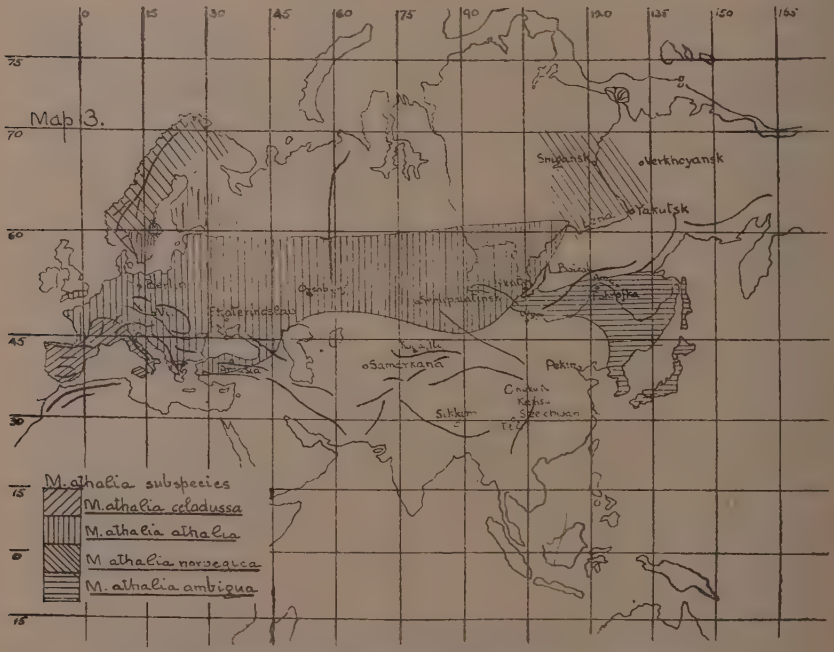
Map 2.—The genus *Mellicta*. Western limit of the typical species of Eastern Europe.

alone in the genus show any departure from standard patterns. The former and *M. asteria* are true alpine species found only above the tree-line with a restricted distribution through the main chain of the European Alps, the latter only on the eastern peaks. *M. athalia* in its typical form, with the sub-uncus fully developed, flies over a vast area from northern France through Germany, central and eastern Europe and across Russia and western Siberia. It extends far north into the arctic regions where it appears in a slightly modified sub species (*M. athalia norvegica* Aurivillius) in Norway and Sweden and most probably also in Russia. East of the European Alps the number of species is much reduced. In addition to *athalia* only *aurelia* and *britomartis* appear as widely distributed butterflies as far east at least as the southern Ural Mts. The last is widely distributed through eastern Asia and is the only species that may be said truly to unite the western and eastern distributional areas of the genus.

The following forms appear in eastern Asia :—

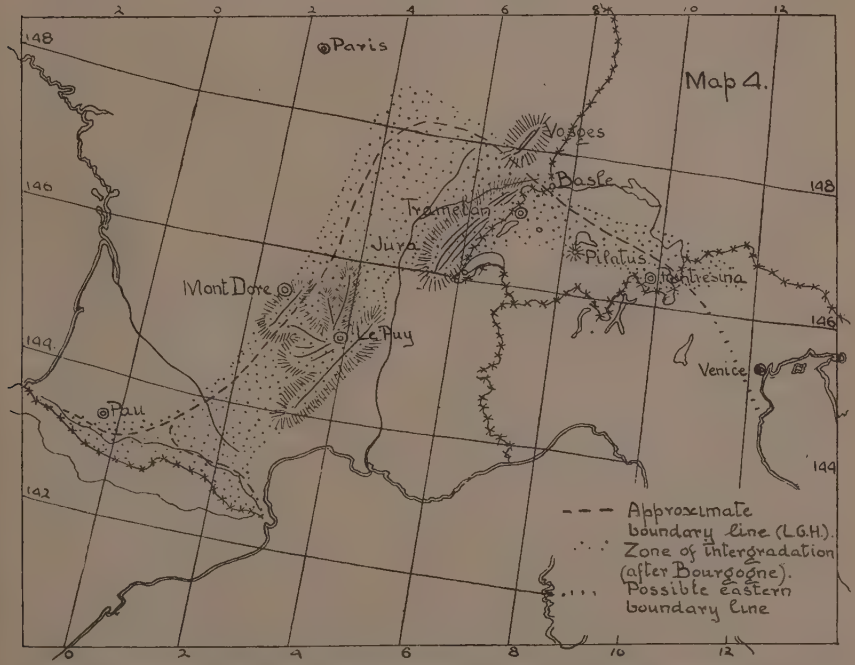
1. *M. athalia ambigua* Ménétriés.
2. *M. centralasiae* Wnukowsky.
3. *M. menetriesi* Caradja.
4. *M. rebeli* Wnukowsky.
5. *M. britomartis amurensis* Staudinger.
6. *M. britomartis latefascia* Fixsen.
7. *M. plotina* Bremer.
8. *M. alatauica* Staudinger.

In addition *aurelia* has produced 2 eastern subspecies, one in the central Caucasus (*M. aurelia albimaculata* Nies), and another recently discovered



MAP 3.—*Mellicta athalia* Rottemburg. Distribution of subspecies.

in the north-western Thian-Shan, in a region far removed from the usual habitat of the oriental *Mellicta*. It carries no subuncus and on this account shows western affinities. The same may be said of *alatauica* Staudinger, which appears as an isolated alpine form in the Dzungarian Ala-Tau, and is also without a sub-uncus. A small form of the western *athalia* flies in the Altai Mts. and in more typical examples in the Changai and Kentei Mts. North and east of this, around Lake Baical, in the Sajan Mts. and down the Amur River, the place of *athalia* is taken by the eastern subspecies, *ambigua* Ménétriés. Further east this grades finally into the splendid *niphona* Butler of Manchuria and Japan, which fully upholds the luxuriant character of the local forms peculiar to this region. In the same area flies *M. centralasiae* Wnukowsky, closely allied to the western *aurelia*, and another form, *amurensis* Staudinger, which appears to be conspecific with *britomartis* Assman, is common and distributed as far east as Sutschan or even into Korea. *M. rebeli* Wnukowsky is a high alpine form known only from a restricted area in the eastern Altai and Sajan Mts. At lower levels occurs *M. plotina* Bremer, which appears to have an extensive distribution down the Amur Valley and in the Ussuri Province. It is an isolated form and easily recognisable—an unusual feature in the genus. *M. latefascia* Fixsen is an obscure form which I have associated with *britomartis* as the genitalia cannot be distinguished. It is known only from Korea and possibly from Sachalin, and further knowledge of its distribution and ecology is needed to determine its correct taxonomic position. Finally *M. menetriesi* Caradja is



MAP 4—Junction zone of *M. athalia athalia* Rott. and *M. athalia celadussa* Fruhst.

known from Kamschatka, where it appears to be the only form of the genus that occurs. Dark forms of *centralasiae* are known to occur far north, within the Arctic Circle at Shigansk and at Sredne Kolymsk. With these exceptions the Melitaeine fauna of the vast spaces north and east of the Amur valley is unknown to Europeans.

Variation.

Variation met with in this genus may be considered in three different categories as follows :—

(1) The true subspecies.

(2) Environmental or ecological variation (including micro-subspecies).

(3) Aberrations : i.e. irregular pattern mosaics, associated with partial obliteration, extension or fusion of the normal macules or abnormality of the wing-markings.

(1) *The Subspecies.*

It is generally recognised that the taxonomic relations of species and subspecies may be exceedingly complex and this is true of *Mellicta*. In this group of non-migratory butterflies, living in colonies often restricted by ecological conditions to relatively small areas, the conditions for subspecific differentiation appear ideal. Indeed the local variation shown by the widely distributed *M. athalia* is quite bewildering and it is scarcely too much to say that the population of each locality will show a slightly different facies. But the position is complicated by several factors, and especially by a marked sensitivity to climatic conditions that is obvious in some species, especially in *athalia* (see below). In almost all cases the local races appear to show the effect of modification by the local ecological conditions sometimes combined with slight divergence in small details of pattern, often too subtle to allow convincing description but more or less obvious when adequate series from different localities are compared. This is a state of affairs that would be anticipated in an insect such as *athalia* with a wide but discontinuous distribution. It is difficult to assess the taxonomic value of these forms of which such a large number have been described and named as subspecies by various authors. But examination of really extensive material shows that most often the so-called subspecific characters intergrade and precise definition becomes impossible. In other words the characters illustrate a step in a graduated series and the variation is not of the subspecific order. In most localities, too, there is great individual variation in the details of markings and colour. This means that a specified subspecific holotype specimen will not be truly representative of the so-called " sub-species," since in a series of a dozen examples from a given locality it is quite likely that no two will match in external characters. Verity overcomes this difficulty when describing these " races " by talking of the " form from so-and-so " with a description of the general appearance or mean of the characters of a series of individuals, and in this way he avoids the impossible task of defining characters in such a way as to apply to all members of a given series. This method lacks precision and is likely to obscure the scope of true subspecific or geographical variation, but I agree with him that these modifications cannot be accepted as subspecies. Huxley (1942, *Evolution. The Modern Synthesis*) has given much attention to the matter and suggests that

names given to phenotypical modifications and micro-subspecies should not be subject to the International Rules, i.e. the category is outside the accepted trinomial nomenclature of genus, species and subspecies. In fact, the decisions taken by the International Commission on Zoological Nomenclature at Paris in 1948 have brought such a plan into operation. I have decided therefore to place as subspecies only forms that fulfil certain requirements as follows :—

(*a*) They must be shown to occupy a definite geographical territory.

(*b*) It should be possible to describe the subspecific characters with reasonable precision.

(*c*) It should be possible to recognise the subspecific characters in all members of the subspecies excepting only those intermediate forms which may appear at the distributional boundaries.

Defined in this way, subspecies represent definite taxonomic units " something of the same general nature as a species—i.e. unique groups with definite characters shared by the whole population and definite areas of distribution " (Huxley, *loc. cit.*, 226). So far as the external markings are concerned, it seems clear that departure from the normal cline must be an essential feature in suggesting subspecific differentiation. Within these limitations the species of *Mellicta* show several interesting subspecific divisions, of which the most important are found in the widely distributed species *athalia*. This species is plainly divisible, upon the characters of the male genitalia, into a western subspecies in south-western Europe including Italy, a central subspecies distributed across Europe north of the Alps and extending through western Asia, and an eastern subspecies which extends from the eastern Altai and Sajan mountains along the Amur to the Pacific coast. A fourth sub-species, distinguished by the characteristic wing-pattern, appears in Scandinavia and extends far north of the Arctic circle ; in this case it is almost certain that there are important ecological differences and changed physiology. Still another form occurs in the extreme south of Spain, in the Sierra Nevada, a region that belongs rather to Africa than to Europe, which shows divergent wing-pattern and is probably to be ranked as a subspecies or micro-subspecies. In other species subspecific differentiation is unexpectedly rare. I have no doubt that the explanation lies in the extraordinarily constant and uniform generic wing-pattern. Indeed this pattern is so firmly established that in some cases even specific units show little or no alteration in wing-pattern one from another and it is most unlikely that subspecific units will be more easily recognised by external features.

(2) *Environmental or Ecological Variation* (*Phenotypical Variation* (*Mayr*).)

A very different approach is clearly necessary in analysing the striking local variation in wing-marking and colour that is a special feature of the genus. Such changes include extension or contraction of the normal black pattern, lighter or darker tone of the ground-colour and variation in size. There is an obvious relationship between such variation and climatic factors on the lines already determined by Hovanitz in two admirable papers (1940, 1941). He was able to show that the reaction of many butterflies to decreasing temperature and sunshine with increasing humidity was :

(*a*) Intensification and extension of melanin pigment.

(*b*) Intensification, i.e. darker tone of the orange ground-colour.

These effects are very evident in the genus *Mellicta*. The distribution and

arrangement of the different modifications strongly suggests an ecological basis for the variation and in my view no other explanation will account for the facts. The changes are naturally most obvious in species with a wide distribution and especially in *M. athalia*. Series taken appropriately from selected localities through the distribution area will show most distinct differences, but further examination of adequate material will show that the characters intergrade from one district to another. The presumed geographical character of the variation is impossible to maintain, since similar forms appear in areas that are not connected in any way, and it becomes obvious that the distinctive features are only different phases in a character gradient of which the extreme forms may be quite dissimilar but connected by every intermediate development, a series to which Huxley has given the term cline (Huxley, 1939, 1940, etc.). The phenomenon is well-marked in several species of *Mellicta* and appears commonly throughout the Melitaeinae, a situation which provides an example of what Huxley has called an external ecocline. In some recent work in other groups, there has been an attempt to define as subspecies arbitrary steps (isophenes) along such a gradient. This appears to me entirely wrong as it hides the essentially graded nature of the variation observed and distorts the picture of the organic pattern. It requires also a misuse of the subspecific category which should imply a partial or modified degree of differentiation of the same order as that which obtains between species, with distinctive characters that are present in all individuals.

The most obvious of the clines met with are as follows :

(i) Larger or smaller size.

(ii) Extension or contraction of the black pattern on the upper surface.

(iii) Darker or paler ground-colour on the upper surface.

It is noticeable that the variable features of colour and wing-marking are all found on the upper surface ; I have not been able to detect any character gradient in the more complicated pattern on the under surface of the hind wings.

(i) In many cases a difference of size is undoubtedly due to abundance or scarcity of foodstuff or is related to the length of the feeding period. In this way we can explain the general reduction in size of second-brood specimens which may be regarded perhaps as starved individuals. High alpine species are also small and often the high sub-alpine modifications of temperate forms are smaller than usual. On the other hand, large examples are common in warm countries but only in early broods, perhaps associated with the luxuriant growth of vegetation in early spring. In this respect it is noticeable that populations living near the sea are often composed of large specimens. I believe this fact may depend upon the well-known moderation of climate in maritime districts with good rainfall and increased moisture. In Italy the large size of specimens from some coastal colonies of *M. athalia* is most striking (e.g. *athalia maxima* Turati, Calabria and Isle of Elba).

(ii) Variation in the extent of black markings, by hiding or revealing the ground-colour, provides most striking extremes of clinal variation. Species which live normally at low or moderate elevations seem especially sensitive. Dark modifications of *aurelia*, and especially of *athalia*, occur in districts with long cold winters, for example in the Dolomites, the Balkan Mountains, the Urals, Caucasus etc. In the Altai, Sajan and Kentei Mountains, all *Mellicta* species appear in dark forms. The appearance of such parallel variation among

widely separated populations is characteristic of ecological character gradients (Huxley, 1942 : 215). On the other hand, in warm and dry localities the black pattern is less prominent, allowing more of the orange ground-colour to appear and the tone of the upper surface becomes lighter. I have no doubt that this climatic factor is important in determining the relatively dark modifications of *aurelia* and *athalia* which fly in southern Germany and Austria, which contrast so strongly with the bright forms that appear along the southern slopes of the Alps and in southern Europe generally.

(iii) Change in the tone of the ground-colour is usually associated with alteration in other features. Hot and dry conditions produce a pale tone that is exaggerated by the thin and scanty markings that appear in all such forms. Examples from warm and damp localities show a darker fulvous which will be accompanied by heavier black markings, and the impression of dark colour is thereby increased. Most species of the genus show evidence of modification along the lines broadly outlined above, and no doubt there are other factors involved that are not yet understood. The phenomenon, as it appears in some related American species, is admirably illustrated by Hovanitz (1941). Forms with restricted habitat usually appear with external features expressing the average formula for the genus for the particular environment. For example *M. deione* Geyer, which flies only in very warm and dry localities in south-western Europe, shows a pale ground-colour and thin black pattern. A great number of names have been bestowed upon the different phases of such character gradients, often referred to as subspecies, and, although this treatment is not acceptable, some indication is certainly required for the most impressive forms. These are now described as modifications. This term has been used before (Osthelder 1925 ; Higgins 1941, 1950) and seems particularly appropriate and useful. It suggests the modifying influence of environment as the principal causative factor and on this account I think it is to be preferred to " race " (Verity) or "Colour Race" ; "ecotype" and "ecogenotype" of Hovanitz or " phenotype " (Mayr). As suggested by Huxley (1940) this nomenclature is not related to the orthodox categories of species and subspecies. Indeed the modifications observed may appear in several species and often require description independently of specific and subspecific groups, i.e. the variation is infra-subspecific. There is much to be said in favour of considering such changes independently in a special section, but in practice I think this would lead to confusion. The most striking modifications are recorded under specific headings, and placed after the subspecific descriptions. They are selected in arbitrary fashion to indicate recognisable phases of variation along the principal clines. This appears to be the most useful method of referring to these series in which the number of possible intermediate forms is so great that an attempt to refer to each one is bewildering. It is convenient to group the modifications of *athalia* under eight headings as follows :

(1) Forms of moderate size and average marking—the typical or normal form.

(2) Forms of small size and normal colour.

(3) Forms of large size and normal colour.

(4) Brightly marked forms of moderate size (the normal form in southern Europe).

(5) Pale forms of small size.
(6) Pale forms of large size.
(7) Very dark forms (usually small).
(8) Dark forms of large size.

All these forms are known in the case of *athalia* : three are known in *aurelia* : *parthenoides* and *britomartis*. A suitable name is available for each modification but it must not be forgotten that the names embrace variable series with characters more or less developed, and, in each group, the extreme examples show transition towards other forms with the same characters, either more marked or less pronounced.

(3) *Aberrational Variation* (*Polymorphism*).

This is considered fully on p. 95.

3. THE SPECIES OF *MELLICTA*.

MELLICTA ATHALIA Rottemburg. Distribution Maps 1, 2, 3.

The original description is not adequate to allow identification, but the specific identity is now fixed by convention, with Paris as the locality of the typical subspecies.

External characters. This insect varies so much in size and colour that it is nearly impossible to give any description in general terms that will cover the numerous modifications. The following features should be noticed : On the upper surface the standard black pattern is often rather heavily marked and sometimes irregular. On the under surface of the fore wing the marks in the cell and the discal macules are generally present, but there is commonly a wide and clear post-discal field. Good coloured figures are given by Reverdin (1922, *Bull. Soc. lep. Genève* **5** : Pl. I, figs. 1, 2, 3, 6, 7, 8) and excellent photographs by Verity (1940).

General distribution. It is noteworthy that in each group of the Palaearctic Melitaeine butterflies there exist one or two widely distributed species and a number of more local forms. In *Mellicta* it is *athalia* that shows the widest range, followed probably by *aurelia* and *britomartis*, while the ten remaining species are all more or less restricted in their habitat.

Unlike most of its allies, *athalia* appears to possess unusual powers of adaptation to differing ecological conditions and on this account it has been able to establish itself across Europe from the Mediterranean to the Arctic Ocean and from the coasts of Brittany over two continents to the Pacific Ocean. In the south-west of Europe the subspecies *celadussa* Fruhstorfer flies in Spain, Portugal, Italy and south-eastern France, but it has never been reported from Northern Africa. The typical subspecies is found through most of Europe, including the Balkans. It occurs here and there in sub-alpine localities in Asia Minor and the Caucasus, but does not extend to the Lebanon, Elburz and other ranges where the true fauna of Central Asia predominates. In the north *athalia* appears with well-marked subspecific characters in many localities in Scandinavia and Finland, extending far north of the Arctic Circle. Similar small forms appear also in northern Asia in the Altai Mountains and quite possibly may represent the species in the wide area north and east of Lake

Baical about which little is known to western entomologists. In the east *athalia* passes through the Dzungarian Gate into Mongolia, where it flies in the Changai and Kentei Mountains. South and east of the Altai the true fauna of the Manchurian Refuge area appears and *athalia* is replaced by the oriental subspecies, *ambigua* Ménétriés, which occurs in a variety of forms in Transbaicalia and down the Amur to the Ussuri, Korea and Japan.

In this wide area of distribution *athalia* must exist under an astonishing variety of ecological conditions. It is hard to think of greater contrast in environment than that which exists between the arid slopes of Mt. Mulhacen in the Sierra Nevada and the low hills near Petsamo in Finland, where I have taken the insect flying within 25 miles of the Arctic Ocean at an altitude of over 1000 ft.

Localities.—EUROPE : Distributed over the whole continent with the exception of Eire, Scotland and the Mediterranean Islands, but including Sicily. It is generally common and often quite abundant in the temperate central districts. ASIA : Said to be generally distributed through Asiatic Russia (Erschoff & Feld). Local in Asia Minor. Taurus Mts. (Staudinger), Brussa ; Anatolia, Ilkas Dagh ; Caucasus, Borjom. Siberia : Appears to occur on all high mountains north of the Dzungarian Gate—Altai Mts.; Changai Mts. A few specimens from northern Siberia have been seen—Vitim R.; Shigansk. Further east the oriental subspecies *ambigua* replaces typical *athalia* in the Sajan Mts. ; and beyond Lake Baical down the Amur, and Ussuri to Sutschan, Korea and Japan.

Subspecies.

Mellicta athalia provides examples of true subspecies differentiation of unusual interest. Only in the case of the arctic and sub-arctic forms of Scandinavia does the pattern and general *facies* make a subspecific distinction possible, and in this case the genitalia do not differ in character from those of other northern European races. Through the greater part of the distribution area the obvious features of size and pattern show such individual variation and are so sensitive to ecological conditions, that they are quite unsuitable as characters for the display of geographical groups or races. Fortunately precise and constant characters appear in the male genitalia which show important differences by which the species is divided quite naturally into three subspecies —*athalia* Rott., *celadussa* Fruhst. and *ambigua* Ménétriés. The genitalia are so greatly modified that in each case the forms were accepted at first as distinct species. In the case of *athalia* and *celadussa* it has been known for many years that the former occurred in northern and eastern Europe, the latter in a relatively restricted region in the south-west, and the boundary zone is established accurately at least in the western range (Map. 1, p. 8). At this point the genitalic characters show a steep cline over a space of 30 or 40 miles, passing with every grade of intermediate formation from one type to the other as the boundary zone is traversed. The subspecific status of *ambigua* is less secure, and satisfactory demonstration is made difficult by lack of material from the area of fusion with *athalia*. Nevertheless, in my view, there are several features indicating that this form should be taken as a subspecies within the *athalia* specific group. The two forms *athalia* and *ambigua* occupy contiguous dis-

tribution areas, but without overlap. They are therefore vicarious one to the other. They are clearly most closely allied by external markings and by genital anatomy, and the physiological reaction to environment, i.e. ecological variation, appears to show quite similar changes in *athalia*, *celadussa* and *ambigua*. I have preparations from the Kentei Mts. and from the Tunkun Mts. in eastern Sajan which appear so far intermediate that I am unable to determine to which form they belong (fig. 26). Verity, also, has illustrated such specimens as follows :

No. 260. Loc. " Altai Mts." Shows a slightly notched tegumen but the posterior process of the clasp is nearer to *athalia*.

No. 259. Loc. " Transbaical." The tegumen is short but with definite notches on the subunci. The posterior process of the clasp is not well displayed, but it is not typical of *ambigua* but nearer to the " wide " type of *athalia*.

The suggestion that *ambigua* is best treated as an oriental sub-species of *athalia* conforms entirely with the known position in other members of the family, and the species complex falls quite naturally into line with *M. didyma* Esper and *E. aurinia* Rottemburg, both of which show the same type of distribution.

Five subspecies are recognised.

1. *Mellicta athalia athalia* (Rottemburg) **comb. nov.**

Papilio athalia von Rottemburg, 1775, *Naturforscher*, *Halle*, **6** : 5. Loc. Paris is specified as the typical locality.

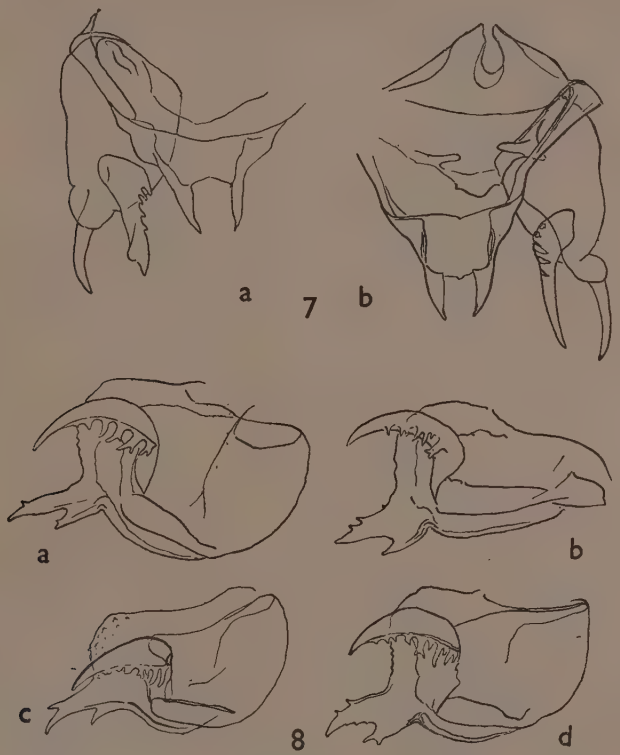
The size is variable.

On the upper surface the ground-colour is a medium shade of orange-brown. The usual black markings are often rather heavy. The sexes are similar but extension of the black pattern is more common in the female. On the under surface the markings are not distinctive. This short description of the external characters applies to the typical form from Paris.

The distinctive subspecific characters are found only in the male genitalia. The critical subspecific feature is the presence of well-developed sub-uncal processes (figs. 3, 7, 11), the limbs of which are sometimes slender and in other cases wide and strong. The tegumen is relatively long. The clasp in lateral view is broadly oval, the posterior process often bifid with a longer tapering upper limb, which may carry several secondary teeth and a shorter inferior limb (figs. 8 and 10). In some cases the process is wider and shorter, and the inferior limb may be notched and provided with smaller teeth (fig. 8*d*). There is some geographical significance in these variations. The short and wide process appears most commonly in specimens from the north-western area of distribution, but this form does not appear to be constant in any locality. In the far eastern range, in the Altai Mts., Changai Mts. and in a specimen from Witim the posterior process is unusually long (fig. 10*b*). In dorsal view the harpe is straight (fig. 7) ; in lateral view it is gently curved and armed with prominent teeth (figs. 8, 10). The aedeagus (fig. 9) is large for the size of the insect and nearly straight. The ostium-keel is fully exposed by the ample ostium-folds ; the morula is not obvious. The female genitalia are shown in figs. 6 and 12. The conspicuous bifid bacillus shows fine teeth on the medial aspect of each limb. It arises from a large genital plate.

Early stages. The egg is of the usual shape and rather larger than that of most related species (Urbahn, Pl. 12, fig. 1a). According to Urbahn eggs are

laid upon the blossoms of *Veronica* and more rarely upon *Melampyrum* and *Plantago*. The winter is passed in the third instar, and it is not clearly stated whether *Plantago* is accepted as a food-plant before hibernation. Frionnet mentions also the food-plants *Centaurea*, *Hieracium*, *Valeriana*, *Chrysanthemum*, *Digitalis*, *Teucrium* ; but these are not confirmed by other authors. The fully-grown larva (Urbahn, Pl. 13a, fig. 3) is black and covered with small white points not so large as to obscure the dark ground-colour. The pupa (Urbahn, Pl. 14b) is dark, with orange and pale markings, which are clearly distinctive.



Figs. 7–8.—*Mellicta athalia*. (7) Male genitalia, dorsal view. *a*, Kent, England ; *b*, Podolia. (8) Clasp, lateral view. *a*, Kent, England ; *b*, Paris ; *c* and *d*, Bavaria, Schliersee.

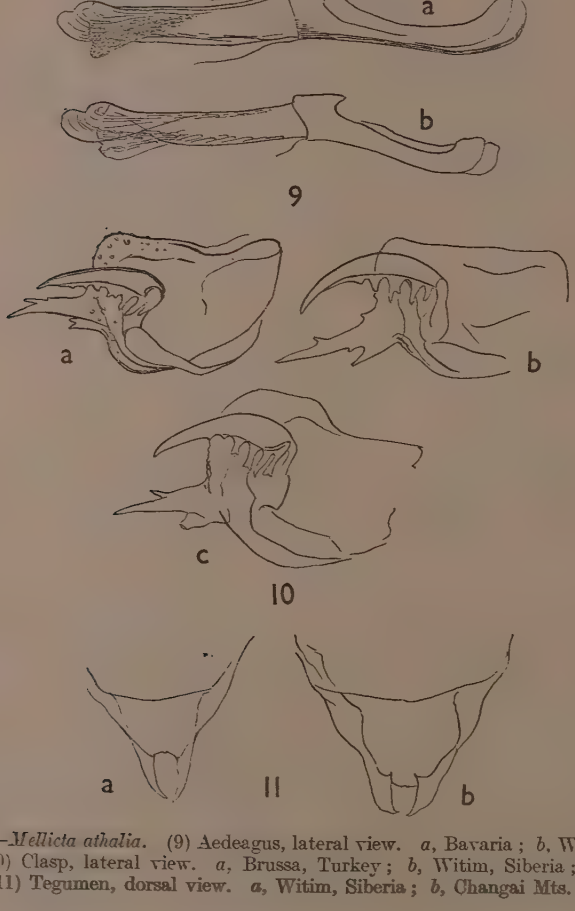
The most obvious specific feature appears to be a mark shaped like a cross on the dorsum of the thorax. The distinction can be seen in the figures, but it is difficult to put into words.

Variation. The marked local variation met with in this sub-species is dealt with on p. 37 and need not be considered further here.

Identification. Few allied species fly with *athalia*. Confusion is not likely with *aurelia*, which is a smaller butterfly. Forms of *britomartis* may occur

with *athalia*, but as a rule this insect also is smaller, and in most cases shows several distinctive features (see p. 61). In south-western Germany there is a small area where *parthenoides* and *athalia* overlap.

Distribution. The sub-species *athalia* flies in central, eastern and northern Europe, excluding northern Scandinavia and Finland, in the Balkans, European and Asiatic Russia and western Siberia, and in the Altai, Changai and Kentei Mountains of eastern Asia.



FIGS. 9–11.—*Mellicta athalia*. (9) Aedeagus, lateral view. *a*, Bavaria; *b*, Witim, Siberia Or. (10) Clasp, lateral view. *a*, Brussa, Turkey; *b*, Witim, Siberia; *c*, Changai Mts. (11) Tegumen, dorsal view. *a*, Witim, Siberia; *b*, Changai Mts.

In certain countries the distribution needs more accurate indication. ENGLAND: Uncommon and very local in the south; there are no reliable records from Eire. FRANCE: Generally distributed except in the south-east. ITALY: Appears only in the north-east. SCANDINAVIA: Only in the open and woodland

country of the south, up to approximately 62 deg. north latitude. FINLAND : Not in the arctic northern regions. GREECE : Not recorded south of the gulf of Corinth. ASIATIC TURKEY : Local and uncommon here and there in Western Anatolia as far east as the Sultan Dagh. SIBERIA : I have normal specimens from the Changai Mts. and dark modifications from the Kentei Mts. and " Tura." In addition I have small examples from the Altai with fine regular markings that do not correspond with *norvegica* Aurivillius. These appear to represent an unnamed modification, which is now named and described as follows :

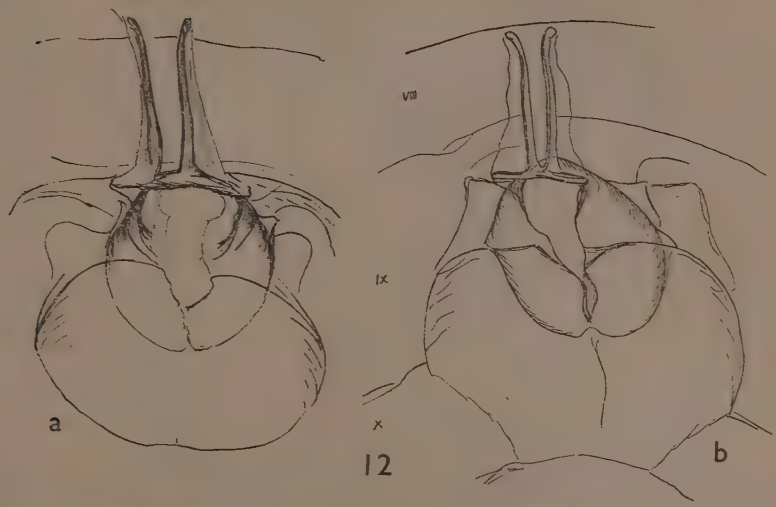


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FIG. 12.—*Mellicta athalia*. Female genitalia. *a*, Stelzing, Austria. *b*, Schlesien.

Mellicta athalia mod. ***reticulata*** mod. n. Pl. I fig. 12.

Male fore wing 13 mm.–17 mm. Exp. 26 mm.–30 mm.

In this small form, on the upper surface, the wing markings are fine and regular. There is an approach to *norvegica* Auriv. but the *facies* is obviously different, perhaps because the tendency to widening of the post-discal orange macules of the fore wing is not apparent. On the under surface the usual markings are present and well developed.

Described from five specimens received from Staudinger and all marked " Altai centr. mont." In one specimen on the upper surface the hing wings are dark and only the orange submarginal macules appear. A specimen labelled " Vitim " and another from Munko Sardyk probably belong to this form.

From the series in my collection it appears that in the Altai the small *athalia* fly with *britomartis* forms and the two species cannot be distinguished with certainty without examination of the genitalia. I have no female specimens that can be associated with certainty with the small *athalia*. The holotype male is in my collection, with four male paratypes.

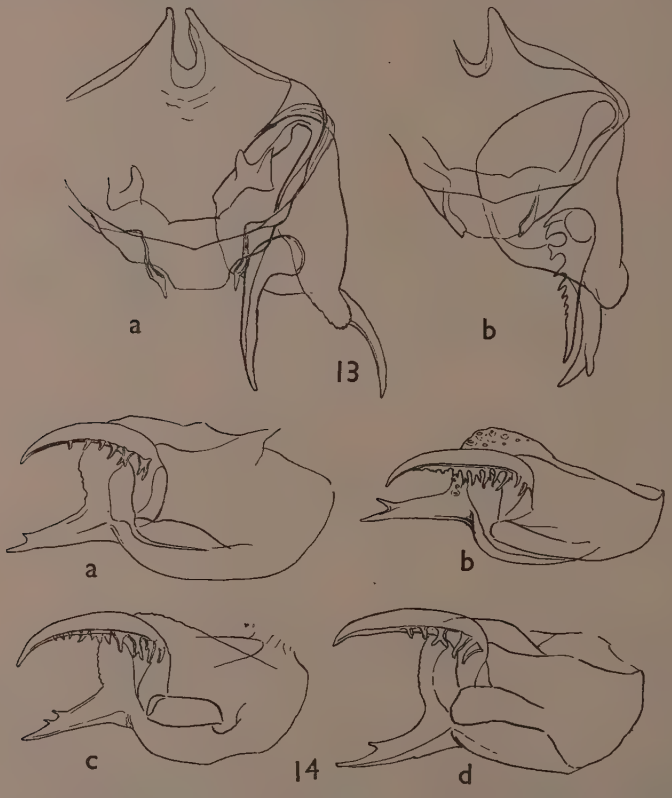
2. *Mellicta athalia celadussa* (Fruhstorfer) **comb. nov.**

Melitaea athalia celadussa Fruhstorfer, 1910, *Soc. ent.* **25** : 51. Loc. Tenda, Alpes Maritimes, France.

Melitaea pseudathalia Reverdin, 1921, *Bull. Soc. ent. Fr.* **1920** : 319.

Loc. Various localities in South-western Europe (*see* p. 43). The male holotype and 5 paratypes now preserved in the Fruhstorfer collection in Paris.

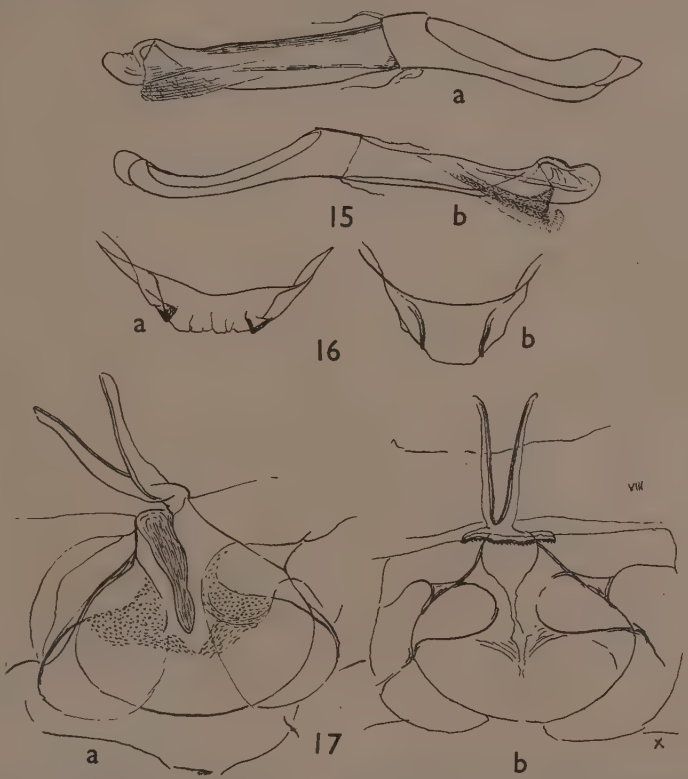
Several difficulties arise in settling the correct nomenclature of this subspecies, which is surprising since all names involved are relatively recent.



Figs. 13–14.—*Mellicta athalia celadussa* (Fruhstorfer). (13) Male genitalia, dorsal view. *a*, Le Rozier (shows slight intermediate characters) ; *b*, Fusio. (14) Clasp, lateral view. *a*, Portugal ; *b*, Bolognola ; *c*, Limone, Piedmont ; *d*, Eclepens, Vaud.

Although the subspecific characters, found in the male genitalia, were defined first by Reverdin in 1920 and described as *pseudathalia*, it has been claimed that the first description of a special form from the known distribution area was that of *helvetica* Ruhl, 1888. In my view it is impossible to accept *helvetica* as a synonym of *pseudathalia*, for reasons explained upon p. 111. Many years ago

Beuret (1933, *Mitt. schweiz. ent. Ges.* **15** : 447) pointed out these difficulties and I think it must be said that the identity of *helvetica* is open to question. Beuret suggested that the name should be replaced by *celadussa* Fruhstorfer, 1910. There can be no doubt that this is the oldest name that applies unquestionably to the sub-species,[1] of which the holotype exists and the typical locality is definitely known and therefore it must take precedence over *pseudathalia* Rev., 1920.



FIGS. 15–17.—*Mellicta athalia celadussa.* (15) Male genitalia, aedeagus, lateral view. *a*, Portugal; *b*, Piedmont. (16) Tegumen. Peninsular Italy. *a*, San Fili; *b*, Bolognola. (17) Female genitalia, dorsal view. *a*, Alpes Maritimes; *b*, Piedmont.

In its external markings this sub-species does not differ from typical *athalia*. The distinctive characters are to be found in the genitalia. In the male (fig. 13) the most striking feature is the simple, narrow tegumen without any evidence of sub-uncal processes. In its extreme form this feature appears principally in examples from the peninsula of Italy. In specimens from France and from the southern Alps there are commonly rudimentary points or processes (fig. 13*a*). In certain areas along the zone of confluence between *athalia* and *celadussa* the tegumen becomes quite variable and the sub-uncal processes

[1] Excluding *cymothoë* Bertolini, 1829. See p. 97.

are more or less developed (fig. 18). In lateral view special features appear in the shape of the terminal process of the clasp (fig. 14), which tapers gradually to a point, showing one or two secondary teeth on the upper border near the apex.

The harpe is conspicuously long and relatively straight, with finely sculptured teeth. The aedeagus (fig. 15) shows no constant distinction from typical *athalia*. The female genitalia (fig. 17) are well characterised. Compared with typical *athalia* the cone is narrower, the scutum smaller and usually divided into two lateral plates. As a rule the auricles are better developed. In fig. 17*a* I have attempted to show the fine sculpture that appears on the ventral surface of the genital plate.

Early stages. According to Beuret (1933, *Mitt. schweiz. ent. Ges.* **15** : 424) the two forms *athalia* and *celadussa* show well-marked differences in their early stages. He found the egg of *celadussa* constantly larger, with traces of fine cross-lines between the longitudinal ribs. The larvae obtained in Valais were separable in all stages from German *athalia*. When fully grown the larva of *athalia* is black with rather large white spots, a black streak running down the dorsum and with thick ivory-white spines. On the other hand, in *celadussa* the white points are very small, the black dorsal line is scarcely visible and the spines are more slender, and orange or darker grey. The pupa also shows constant differences ; that of *athalia* is decidedly smaller. This description does not quite agree with that of Urbahn, who says the sandy-yellow spines are placed on yellow macules in *athalia*, and that the black line down the back is not always visible. It is possible that this discrepancy implies local or regional variation in larval characters.

Identification. Confusion may occur with *parthenoides* Keferstein and with *deione* Geyer, both species that fly in Spain and in southern France. The neat and regular pattern of *parthenoides* should be distinctive. On the under surface there is often a prominent black bar on the fore wing running along nervure 1, parallel to the inner margin, that is scarcely visible in *athalia*. Viewed from above, the palpi are covered with orange hairs up to the terminal joint. It is less difficult to separate *athalia* from *deione*. On the upper surface the latter shows the well-known X-mark on the black discal fascia near the inner margin. On the hind-wing there is usually a distinct series of black macules across the disc. On the under surface *deione* shows a neat pattern on the hind-wings and the fine black marks across the disc are placed very near the central orange fascia. In both cases some experience is needed to separate the species with confidence.

Variation. Environmental variation occurs along the lines considered above. The dark forms met with in typical *athalia* do not appear. No doubt this is due to the fact that the distribution area lies exclusively in warm districts, among which are the hottest and driest in Europe. At low altitudes throughout the area the species develops two generations each year. The individuals of the second brood are always smaller and paler than those of the first generation, and in the case of some Italian races the modification is most marked.

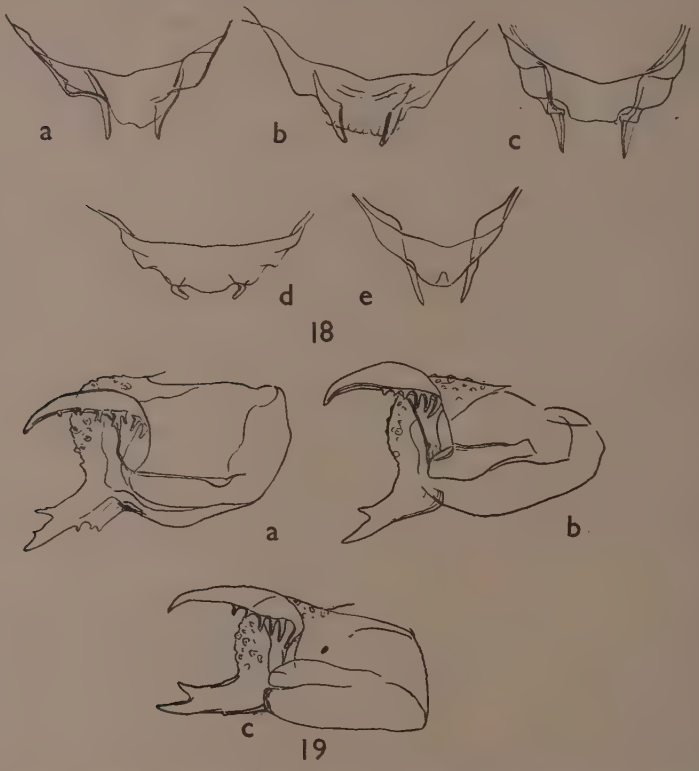
Distribution (Maps 1, 3, 4). This subspecies is confined to south-western Europe in a relatively small region including Spain and Portugal, south-eastern France, southern Switzerland and Italy, excepting the north-east. The zone of fusion with the territory of *athalia* is known accurately in part of its extent. In this transitional zone the species is unstable and intermediate forms of genitalia appear. The following examples of such localities may be given :

Austria : Etschtal (Adige valley), Merano (Beuret). Italy : Val Venosta ; intermediates tending to *athalia* (Beuret). Switzerland : Schuls Tarasp ; intermediates tending to *athalia*. Unter-Engadin ; intermediates tending to *celadussa*. Glarus ; intermediates tending to *celadussa*. Basel ; intermediates tending to *athalia* or *athalia* pure all round this area. Sundgau ; intermediates (Beuret). Mulhouse ; occasional tendency to *celadussa*. Courcelles and Seppois (Belfort) ; *celadussa* with occasional intermediates towards *athalia*. Laufen, Erschwil, Grellingen, Village Neuf, Istein ; intermediates tending to *celadussa* (Beuret). France : Mont Dore ; intermediate and transitional to *athalia*. Le Rozier, Lozère ; *celadussa* and intermediates. Argelès Gazost, Htes. Pyrénées ; *athalia* and intermediates. Gavarnie, Htes. Pyrénées ; *celadussa* and intermediates.

From such data it is possible to show a belt of transition between the two sub-species, the position of which is indicated by the broken line on Map 4. The transition occurs in a graduated series of progressive changes in the genitalia as the boundary is approached and passed (Higgins, 1932), and the passage from one sub-species to another may involve a broad zone many miles in width. The unstable populations in this zone are usually very variable, and examples showing various stages in the passage from one type to another may be taken flying together, although as a rule the features of one or other form will predominate in a given locality. It will be noticed that the Vosges Mts. are peopled by *athalia*, while the population of the Jura Mts. mostly shows *celadussa* characters, with intermediate examples more commonly in the north, while truly transitional specimens occur in the Doubs (Bourgogne). Further south the Massif Central (Puy-de-Dôme) shows intermediate examples in many localities, mostly tending towards *celadussa* except in the west (Mont Dore). The situation in the Pyrenees is peculiar, with intermediates all along the northern slopes, tending rather to *celadussa* in the higher peaks, towards *athalia* in the western foothills and to pure *celadussa* in the lowlands of the east. Only *celadussa* occurs as the watershed is passed into Spain. In Switzerland the transition zone appears to be narrow with pure *athalia* in the north and *celadussa* well developed only in the southern Cantons of Wallis (Valais), Tessin, Uri and the western Grisons. Further east transitional forms fly all down the Engadin valley, to the east of which, in the Oetztaler Alps and on the Ortler, the species appears as homogeneous *athalia*. *M. celadussa* also flies further south and east on the southern slopes of the Alps in northern Italy west of the Adige valley, where intermediates have been recorded by Beuret, but the position here of the transitional belt is not established with certainty. It runs possibly from the southern extremity of Lake Garda along the course of the Adige (Etsch) to the Po. True *athalia* certainly occupy the mountains to the east of the lake, the Dolomites and the plain to the north of Venice. This picture of the geographical distribution of the two forms is confirmed for the western range by Bourgogne (1953) in an excellent paper analysing the results of many years' exploration through various Departments in France. In providing material for his paper, many hundred specimens were examined from a great number of localities. These were attributed to one or other subspecies by an arbitrary formula based upon three well-marked characters capable of accurate measurement :

(1) Length of the tegumen.
(2) Length of the sub-unci.
(3) Development of the lateral tooth of the posterior process of the clasp.

Bourgogne suggests that the transitional belt in France varies in width from about 20 km. a little to the north of the Massif Central to as much as 130 km. in the extreme north-east. As a result of this patient research there are



Figs. 18–19.—*Mellicta athalia*. (18) Tegumen, dorsal view. Transitional specimens. *a*, St. Tryphon ; *b*, Pilatus ; *c*, Argèles ; *d*, Glarus 3 ; *e*, Glarus 1. (19) Clasps, lateral view. Transitional specimens. *a*, Pilatus ; *b* Glarus 3 ; *c*, Glarus 1. (See corresponding tegumina.)

few gaps remaining in knowledge of the distribution of the *athalia* forms in France.

It appears to me that the two forms *athalia* and *celadussa* represent true geographical races or sub-species. They occupy contiguous distribution areas and are vicarious, one replacing the other without invading its territory. Along the territorial boundary (Map 4) the two forms fuse and produce intermediates, such as are shown in figs. 18 and 19. The butterfly provides perhaps the best documented and most perfect example of subspecific differentiation

that occurs in the Palearctic lepidoptera. It is probable that *athalia* and *celadussa* are examples of independent sub-species that have come together relatively recently. Perhaps *celadussa* is to be regarded as an ancient pre-Glacial form, withdrawn for a time into the south-western refuge area in common with other members of the genus in which the sub-uncus is not developed. *M. athalia* may be derived from a more recent Siberian stock that invaded Europe in post-Glacial times, but was not able entirely to traverse the barrier of the Alps.

References of works dealing especially with intermediate forms :

Beuret, H., 1931, *Mitt. schweiz. ent. Ges.* **15** : 78 *et seq.*
——, 1933, *ibid.* **15** : 424 *et seq.*
Bourgogne, J., 1953, *Ann. Soc. ent. Fr.* **122** : 131 *et seq.* (Figures and Maps.)
Higgins, L. G., 1932, *Entomologist* **65** : 217. (Plates.)

Note.—In *Trans. R. ent. Soc. Lond.* **89** : 612, 1940, Dr. Verity has described and figured as *M. athalia* race *asiae* examples reputed to have been found in the Sutschan district of eastern Siberia. He records that these specimens were received from Rutimeyer of Berne. The figures given by Verity correspond perfectly with ordinary *celadussa* from Switzerland, both in external features and in the male genitalia. It is difficult here to avoid a suspicion of some confusion of locality labels, and the occurrence of *athalia celadussa* Fruhstorfer in eastern Asia should not be accepted as proved without confirmation of the most definite and precise nature.

3. *Mellicta athalia nevadensis* (Oberthür) **comb. nov.**

Melitaea deione nevadensis Oberthür, 1904, *Et. Lép. comp.* **1** : 11. Loc. Lanjaron, Sierra Nevada. Figs. 355–358.
Melitaea athalia nevadensis Oberthür, 1909, *loc. cit.* **3** : 251.
Melitaea nevadensis Oberthür, 1910, *loc. cit.* **4** : 672.

The male holotype and female allotype are both in the British Museum (Natural History).

Fore-wing ♂ 18–20 mm. ♀ 19–20 mm.

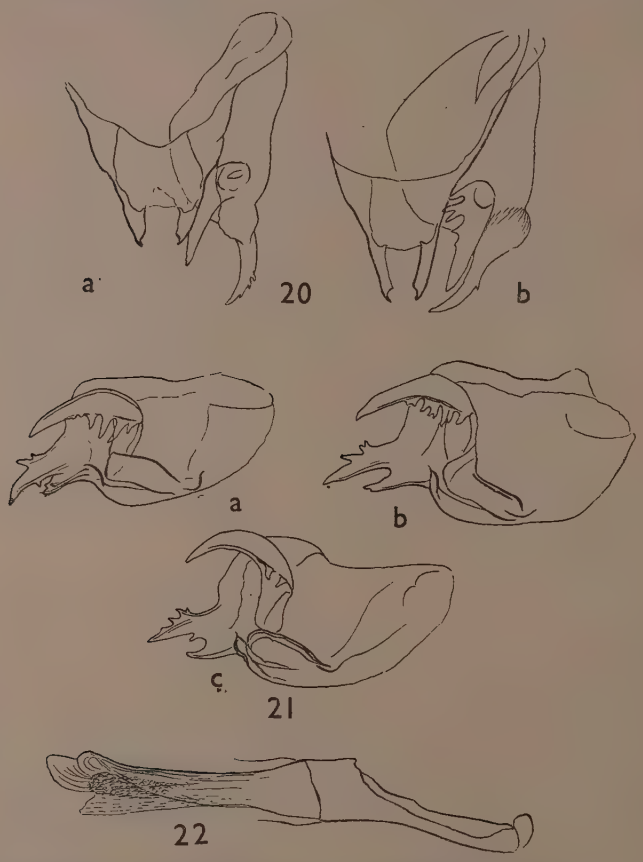
On the upper surface the ground-colour is clear golden yellow. The usual black markings are sharply defined with a minimum of black shading. On the under surface of the hind wing the small orange macules at the base are scarcely if at all joined to the orange macules of the discal fascia, and the yellow marginal lunules are very deep. The female is slightly paler than the male, but otherwise there is little difference.

The pale ground-colour and the fine but clear-cut markings give this form a characteristic appearance unlike other examples that I have seen from localities in Spain. It is therefore difficult to place, and I have dealt with it as a sub-species of the *celadussa* stock of the same category perhaps as *M. deione nitida* Ob. My specimens were taken on Mt. Mulhacen, and as far as I know the only other locality is Lanjaron, on the other side of the same mountain. No doubt the species will be found again in the Sierra Nevada, but it has never been taken elsewhere in southern Spain, and the colonies have been isolated probably for many ages from the nearest known habitats of the species in Castile. The special features are very well shown by Oberthür's excellent figures.

Localities. Mt. Mulhacen, 5000 ft., vi, (L.G.H.); Lanjaron. Sierra Nevada.

4. *Mellicta athalia ambigua* (Ménétriés) **comb. nov.**

Melitaea athalia var. *ambigua* Ménétriés, 1859. Schrenk's *Reisen and Forschungen in Amurland*, p. 24 Pl. 2, fig. 4. Loc. Djai, Amurland. (*N.B.*—This was near the modern town of Blagoveshchensk.)



Figs. 20–22.—*Mellicta athalia ambigua*. (20) Male genitalia, dorsal view. *a*, Tunkun Mts.; *b*, Korea (mod. *niphona* Butl.). (21) Clasp, lateral view. *a*, Korea; *b*, Ussuri; *c*, Raddefskaja, Amur. (22) Aedeagus. Korea.

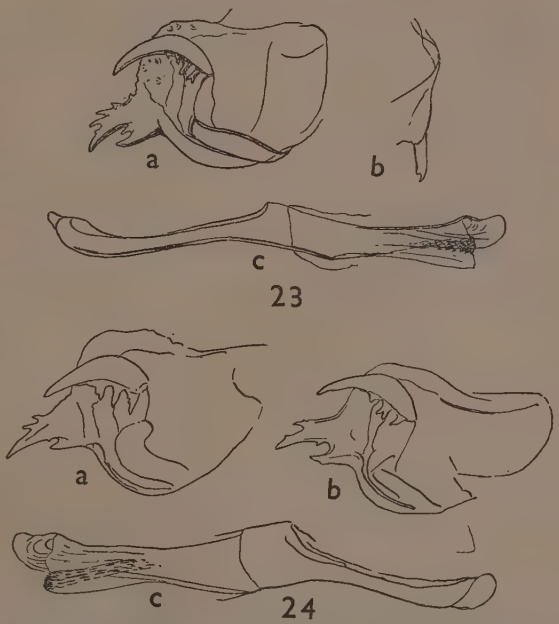
Melitaea athalia kenteana Seitz, 1909, *Gross-schmett. Erde* **1**: 222, Pl. 67A. Loc. Kentei Mts. Name and figure only.

Melitaea ambigua race *sayanskalpina* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89**: 600. Loc. Chulugaischa, East Sajan, and Turkinsk White Mts. Female holotype in Verity Collection.

Figures: Verity 1940, 6–9; 13–15; 10–12 (as *kenteana*); 213 transitional to a paler form.

Ménétriés' original specimen has disappeared and the figure is poor but shows an insect rather below medium size with suffused dark markings on the upper surface. There can be no question here of doubtful specific identity, as there is no other species known to inhabit the Amur to which these simple features could apply.

In its external characters this subspecies often shows slight distinctive features. Compared with western *athalia* the post-discal black fascia on the fore wing is relatively straight and often shows a tendency to become obsolete in cellules 3, 4 and 5. On the under surface of the hind wings the pattern may be very close to *athalia*, but in many examples, especially



Figs. 23–24.—*Mellicta athalia ambigua* (Ménétriés) (paratype of *kenteana* Seitz). (23) *a*, clasp; *b*, tegumen; *c*, aedeagus. (24) *a–b*, clasp, lateral view; Tunkun Mts.; *c*, aedeagus, Tunkun Mts.

in the eastern range, there is a wide brown submarginal fascia in which appear simple orange lunules without any trace of shading or eye-spots. More yellow or pale brown shading around the discal orange fascia may reduce the size of the pale discal macules in a striking manner. This feature is well shown in Verity's figs. 9 and 12, and is commonly seen in the smaller dark forms. I have not seen it in examples from Korea and Japan. The female is usually melanic, with the black pattern on the upper surface more suffused and often with a paler ground-colour. It must be understood that in a majority of specimens these characters are vague and indefinite. In the western range, where small dark forms of both subspecies occur, it is not possible to distinguish between *athalia* and *ambigua* without examination of the genitalia. Further east, in the large forms of the Ussuri valley, the subspecific features are better marked and only *ambigua* occurs.

Genitalia. The distinctive subspecific features are found in the male genitalia. The tegumen (fig. 20) shows unusually straight sub-uncal limbs each of which is slightly excavated or notched at the tip. In lateral view the posterior process of the clasp (fig. 21) shows a longer upper limb and a much shorter lower limb, separated by a deep notch. Two or three small secondary spines are present, especially from the upper border of the process. These special features are best marked in examples from Korea, the maritime districts of the mainland and Japan. The harpe is of moderate size, gently curved with 3 or 4 teeth, a smaller series than is commonly found in western *athalia*. The aedeagus is almost typical, but the ostium crest may be exaggerated, especially in examples from the extreme eastern range (fig. 22). The female genitalia (fig. 25) are remarkable for the very large genital plate.

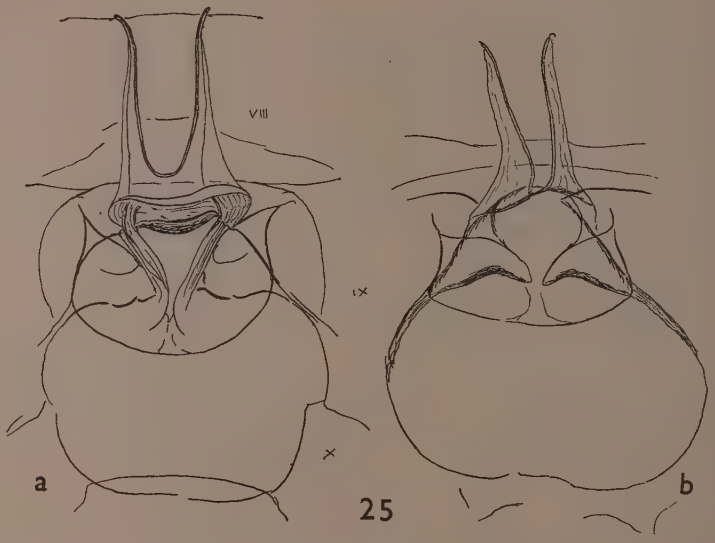


Fig. 25.—*Mellicta athalia ambigua.* Female genitalia, dorsal view. *a*, Oiwake, Japan; *b*, Sidemi, Amur (mod. *niphona* Butl.).

Identification. Forms of *centralasiae* Wnu. and of *britomartis amurensis* Stgr. are common within the distribution area of *ambigua*, but these are smaller insects and confusion is only likely in rare cases, when identification must be confirmed by examination of the male genitalia.

Distribution (Map 3). It is not possible to define the boundary zone between the subspecies *athalia* and *ambigua* in eastern Asia except in the most general way. Verity has recorded *ambigua* from the eastern Altai, but this record needs confirmation, and *athalia* is certainly more frequent in these mountains. South of Lake Baical, in the Sajan Mts., *ambigua* predominates, although I have seen a few *athalia* forms and intermediates from this district (see fig. 26, *a*, *b*). The subspecies flies further south through Tannuola to the Kentei, where *athalia* is more common, but Seitz' *kenteana* is referable to *ambigua*. Further east, *ambigua* occurs all down the Amur valley and into Korea and

Japan. The situation around Lake Baical is obscure. It is possible that *ambigua* inhabits the southern and eastern shores, but Fruhstorfer's *tinica* from " Irkutsk " is *athalia*. There can be little doubt that *ambigua* infiltrates both north and south of the Amur valley, but no material is available to confirm this suggestion.

Variation. The sub-species is clearly most sensitive to environment and shows every grade of transition between the small dark typical forms and the large luxuriant *niphona* Butler. In the western range only small dark forms appear, and so far as I know, these fly at an elevation of 2000 m. or more. The butterfly is not represented in British collections from more eastern districts between the Sajan and Aigun on the lower reaches of the Amur. Eastwards from here, at lower elevations, there appear larger and more brightly coloured forms, which attain their largest size in the extreme east, along the Sutschan

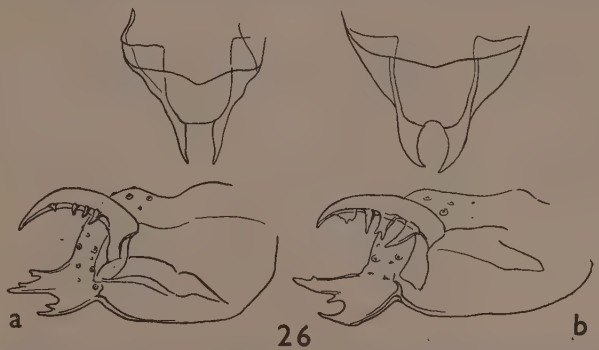


Fig. 26.—Probable intermediate examples *M. athalia athalia—athalia ambigua*. The posterior process of the clasps approaches the structure of *ambigua*. The contrast is especially clear compared with the long and slender process which is common in the *athalia* of the extreme eastern range. (See also fig. 10.)

river, in Korea and Japan. Further north smaller, dark forms are reported again from the region of Nikolaievsk on the Sea of Okhotsk, but without record of altitude (Verity 1940 : 599). It is not easy to decide what form of this variable butterfly should be taken as typical. In the description *ambigua* is compared on the upper surface with *protomedia*, described at the same time, and rather brightly marked, and on the under surface with *deione* Geyer. This suggests a form with lively orange markings and of moderate size, such as occurs at Radde, Charborowka and elsewhere along the Lower Amur, but this does not agree at all with the darkly suffused figure. Verity (1940 : 599 and figs.) attributes to the typical form rather small dark specimens corresponding with the figure. I think this action should be taken as specification of typical *ambigua*. It is convenient to distinguish by name at least three modifications, the small dark typical forms of the west and north, paler forms of moderate size that occur on the Lower Amur and the very large modification that flies near the sea coast and in Japan. All three forms correspond so well with recognised European modifications that there is good reason for employing the same names for *ambigua* as are used for the similar forms of *athalia*. Although this would

simplify nomenclature it would lead to employment of well-known names in an unfamiliar manner, and I have therefore retained racial names for *ambigua* that have been always applied to this insect.

(A) Forms of small size and dark colour. (Equivalent to mod. *noctula* Vorbrodt.)

(1). mod. **ambigua** Ménétriés.

Figures : Verity 1940 6–9 ; 10–12 ; 13–15 ; 213 transitional to a paler form.
Fore-wing ♂ 17–18 mm.; ♀ 18–20 mm.

This name may be used for the relatively small and dark specimens that appear in the western mountains and probably also in the most northern localities. It is precisely comparable with the modification *noctula* Vorbrodt of the western subspecies. I have had an opportunity of examining some of the typical series of Seitz' *kenteana* now in the Senckenberg Museum and I have illustrated a drawing of the male genitalia (fig. 20*a* ; 23, 24) which show typical *ambigua* characters. Examples in my collection which evidently form part of the original series from which Verity described *sayanskalpina* do not appear to me to show any worth-while difference. The localities given below are all carefully checked, but probably these give an incomplete idea of the full distribution of this form, which has yet to be determined.

Localities.—Sajan Mts.; Tunkun Weissberge 2000m ; Munko Sardyk, Mondy ; Baikal ; Kultuk 800 m.; Schawyr ; Tannuola 2500 m.; " Amur". " Altai " reported by Verity, needs confirmation.

(B) Forms of medium size, brightly marked. (Equivalent to *athalia celadussa* Fruhstorfer.)

(2). mod. **bathilda** Fruhstorfer.

Melitaea athalia bathilda Fruhstorfer, 1919, *Arch. Naturgesch.* **83** (A) (3) : 179. Loc. Amur.
Figures : Verity 207 ; 208.
Fore wing : ♂ 18–19 mm.

Fruhstorfer gave this name to specimens of moderate size from the lower Amur valley, which show a bright orange ground-colour and clear black pattern on the upper surface. I have seen such examples from Charborowka, Raddefkaja and other unspecified localities in the Amur valley. The name is useful to indicate intermediate specimens with bright ground colour but too small to rank as *niphona* Butler. This form would correspond with the western modification *celadussa* Fruhstorfer.

Localities.—Raddefskaja ; Charborowka ; " Amur " many examples without good data. Sutschan with larger specimens referable to *niphona* Butler.

(C) Large and bright forms. (Equivalent to *athalia biedermanni* Querci.)

(3). mod. **niphona** Butler.

Melitaea niphona Butler, 1878, *Cistula ent.* **2** : 281. Loc. Japan. Holotype in the British Museum (Natural History).
Melitaea athalia var. *mandschurica* Fixsen, 1887, Romanoff, *Mem. Lép.* **3** : 302. Loc. Korea and Amur Province.

Figures : Leech, *Butterflies of China*, etc., Pl. 24, fig. 7 : Pryer, *Butterflies of Japan*, Pl. 7, fig. 6 ; Verity has not given a figure of typical *niphona*.
Fore-wing ♂ 20–23 mm. ; ♀ 22–24 mm.

In this form the ground colour on the upper surface is bright tawny-orange with all the usual black markings very complete and distinct. There is much individual variation between different specimens from the same locality. The principal distinctive feature is the large size of the specimens and well developed examples are really magnificent insects, which correspond with the modification *biedermanni* Querci of western Europe. I have these large examples from Japan, Korea and Sutschan, mostly mixed with smaller specimens grading into *bathilda* Fruhst. In all cases the female is slightly darker than the male. with more tendency to melanism. The male genitalia (fig. 20*b*, 21, 22) appear identical with those of typical *ambigua*. The aedeagus constantly shows a very large ostium-crest (fig. 22).

Distribution. In the case of *niphona* this is pretty well known. It appears associated with smaller specimens in the maritime districts of the Ussuri and probably also on the lower Amur. It is more constant in Korea and the Japanese islands of Hondo, Yezo and Kiushu, but in all cases small examples may also appear.

Localities. Japan : Yokohama ; Oiwake ; Leech gives the islands of Hondo, Yezo and Kiushu. Korea : Gensan ; all my specimens were collected by Leech. Ussuri and Amur : Sidemi ; Sutschanski Rudnik ; Narva ; mostly with smaller examples.

The following named forms referable to *athalia ambigua* Ménétr. are included among those listed on p. 42 *et seq.*

bathilda. Melitaea athalia bathilda Fruhstorfer, 1919, *Arch. Naturgesch.* **83** (A) (3) : 179. Loc. Radde, Amur. See p. 43.

crassipicta Melitaea ambigua form *crassipicta* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 600. Loc. " Altai ". See p. 44.

nossis Melitaea athalia nossis Fruhstorfer, 1919, *Arch. Naturgesch.* **83** (A) (3) : 180. Loc. Nagasaki, Japan. See p. 47.

sachalinensis Melitaea ambigua sachalinensis Matsumura, 1925, *J. Coll. Agric. Hokkaido Univ.* **15** : 99. See p. 49.

sajanskalpina Melitaea ambigua race *sajanskalpina* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 600. Loc. Eastern Sajan Mts. " Chulugaischa." See p. 49.

5. *Mellicta athalia norvegica* (Aurivillius) **comb. nov.**

Melitaea athalia var. *norvegica* Aurivillius, 1888, *Nordens Fjärilar* : 30. Loc. Dovrefjeld, Norway.

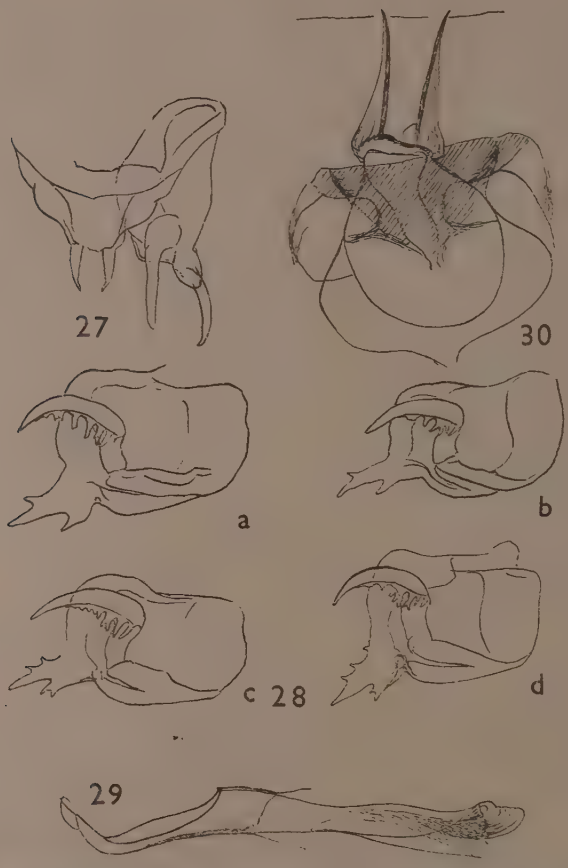
Melitaea aurelia var. *scandinavica* Staudinger, 1892, *Iris* **5** : 327. Loc. Dovrefjeld, Norway.

Melitaea athalia borealis Lindström, 1929, *Ent. Tidskr.* **50** : 226. Nom. nov. pro *M. athalia* var. *parthenie* Auriv. *loc. cit.* Loc. Dovrefjeld, Norway.

Melitaea athalia polaris Rygge, 1921, in *Troms. Mus. Aarsh.* **44** : 16. Loc. Malselvdal. *Nomen nudum.* There is no reason to think that this name was intended to describe a new form. Probably introduced in error.

There can be no doubt that Aurivillius referred most northern and mountain forms of Scandinavian *athalia* to *aurelia* Nickerl under the name of *athalia* var. *parthenie* Borkh. He introduced the name *norvegica* for certain especially

small and pale specimens taken on the Dovrefjeld by Schoyen. These must have been small *athalia*, which is the only species of *Mellicta* that flies in the locality, and, although no holotype is known, *norvegica* can be accepted and extended to include the arctic and mountain forms of the species, as they occur in Scandinavia.



Figs. 27–30.—*Mellicta athalia norvegica* (Stgr.). (27) Male genitalia, dorsal view. Skarnes, Norway. (28) Clasp, lateral view. *a*, Koping; *b*, Dovre; *c*, Dovre; *d*, Skarnes. All from Norway. (29) Aedeagus, lateral view. Skarnes, Norway. (30) Female genitalia, dorsal view.

Fore wing ♂ 14 mm.–16 mm. ♀ 16 mm.–18 mm.

This small butterfly looks quite unlike *athalia*. On the upper surface in the male the ground-colour is often pale, with the black pattern very neat and regular, but in series the insect is most variable. In some specimens the discal macules of the fore wing show up intensely black and exaggerated, in some the submarginal orange macules are enlarged, in others some of the usual black markings on the fore wing are more or less obsolete. A

tendency to melanism is uncommon. On the under surface the ground-colour of the fore wings is very pale and the black markings are usually scanty in the post-discal and submarginal areas. In the female perhaps there is greater individual variation on the upper surface and melanic examples are more common. It is not surprising that early writers placed this form with *aurelia* Nickerl which it resembles so closely. Only in 1912 E. Wahlgren discovered (*Ent. Tidskr.* **31** : 77) that all so-called " *parthenie* " from Dovre and northern Scandinavia were truly forms of *athalia*.

Genitalia. The male genitalia are small, but otherwise resemble those of the typical subspecies (figs. 27, 28, 29). The female genitalia (fig. 30) show no obvious distinctive features.

Variation. This form differs from other sub-species of *athalia* in showing little tendency to environmental variation, perhaps because the environment is so similar in all localities. I have referred to the customary individual variation and Valle mentions the forms *hertha* Quensel and *corythallia* Hübner but I have not seen any striking aberrations. The only named form that is especially referable to this subspecies is *M. athalia* var. *fennica* Petersen (see p. 45).

Distribution (Map 3). The butterfly occurs on the peat moors and uplands up to at least 3000 ft. in Dovre and at 1000 ft. near Petsamo. The flight places are often extremely localised. In Dovre I found a colony beside a small stream and diligent search around an area of 10 miles failed to produce another specimen. Wahlgren (*loc. cit.*) reported *norvegica* from all Norland and Dovre, but said that typical *athalia* appeared in Helsingland and to the south (but see below). I have, however, taken specimens on a large peat moss near Oslo that I can place only as *norvegica*, and this form extends further south in the western mountains (*c.f.* Peterson 1947, Map.). I think it is probably true that *norvegica* is associated with the special biotope of the peat mosses wherever they occur, and more normal *athalia* appears in open country and ordinary woodland. Where *norvegica* flies it appears to be constant and normal specimens of *athalia* do not occur.

Localities.—Fenno-Scandinavia : Local and not very common on the peat mosses and mountainous districts north of the 62nd parallel (Aurivillius). Norway : Dovrefjeld ; Malselvdal ; Memurubu (Jotenheim). Sweden : Wahlgren (1912, *Ent. Tidskr.* **31** : 77) gives Angermanland and north of this. I have it from much further south ; e.g. Saeterstoen and Skarnes, on peat bogs. Finland : Chiefly in the arctic districts, where it is local and scarce, e.g. near Petsamo. Valle (1935) gives many Finnish localities. Russia : The butterfly must occur in Murmansk and probably extends much further east, but data are entirely wanting.

M. athalia norvegica mod. **lachares** Fruhstorfer.

Melitaea athalia lachares Fruhstorfer, 1919, *Arch. Naturgesch.* **83** (A) (3) : 178. Loc. Sweden, Finland, Estland, Norway in mid-July.

Fruhstorfer described a small form. On the under surface the median band of the hind wings is usually narrow and the red-brown markings are sharply defined. In Finnish specimens the black pattern on the upper surface is often

reduced. The male holotype is preserved in the Natural History Museum at Paris, and it is figured by Verity (1940, fig. 225 and ♀ paratype 226). The locality is marked only as "Sweden." These specimens show well the characteristically wide submarginal macules on the upper surface that appear as a special feature of this form, although this is not mentioned by Fruhstorfer in his description. Petersen (1947) has specified southern Stockholm as the locality of typical *lachares*.

Distribution. This interesting modification is peculiar to Scandinavia and it occurs through a relatively narrow belt extending from central Finland across to southern Norway. In this belt, which corresponds roughly with the transitional zone between normal *athalia* and *norvegica*, *lachares* is frequent, but inconstant and associated with *athalia* or with *norvegica* according to circumstances and locality. Unfortunately material from Finland and southern Sweden is poor in the British Museum, and I can give only the following incomplete list of localities:

Finland: Helsinki in coll. L. G. H. A large and well developed form. Sweden: Köping, in coll. L. G. H. Norway: Oslo; Saeterstoyen; Dombaas (occasional examples only).

It is interesting to examine more closely the scheme of modification of *Mellicta athalia* in its extensive distribution through Scandinavia. In the low-lying southern districts on the edge of the deciduous forest zone the insect is represented by the typical subspecies with normal colour and pattern, often rather small and dark. Petersen (1947) refers to these southern specimens as typical *athalia*, but in fact the form should not be associated with Parisian specimens. On the other hand it is certainly close to and probably indentical with the small forms that fly on the peat mosses of southern Bavaria (*suessula* Fruhst.). Such normal *athalia* penetrate northwards along the western shore of the Baltic, perhaps as far as Norland. In many districts and especially near the foothills of the southern mountains, there appears an unusual form in which the submarginal macules on the upper surface are enlarged to form a relatively wide fascia which is quite conspicuous. This is *lachares* of Fruhstorfer referred to above. It often shows a tendency towards extension of the black basal suffusion and elimination of the black markings in the post-discal area of the fore wing. It is peculiar to Scandinavia and is found through a wide belt from southern Finland through southern Sweden and Norway, but my material suggests that it is nowhere constant. In the southern mountains of Norway this form appears in quite small specimens which approach fully developed *norvegica*. In some of these the fore wings are short and square. Further north and west examples showing the characters of *lachares* become scarcer, and *norvegica* appears as a constant geographical form that extends through the land as far north as the Arctic Ocean. This assembly of different forms showing such unusual characters and in a relatively restricted area, creates a situation that is difficult to express in terms of nomenclature. Petersen (1947) has made an original attempt to analyse the distribution and variation of the Scandinavian *athalia* by close analysis of three characters:

(1) Extent of the dark markings on the upper surface.

(2) Width of the yellow lunules along the margin of the under surface of the hind wing.

(3) Intensity of the orange tone on the under surface of the hind wing.

A relationship was shown between the length of the fore wing and the extent of dark shading (character 1). By careful measurement and comparison of these and certain other characters the total population was divided by Petersen into four forms, which he labelled subspecies, each of which corresponds to the mathematical mean (isophene) between certain arbitrary limits of the measurements recorded. It appears to me that this procedure provides a method of separating a continuous series into four groups, but it is of doubtful value in detecting and defining subspecies. In the present case it tends to obscure the continuous passage through a steep cline from *athalia* with normal pattern to the fully developed *norvegica*. This cline is distinguished by the presence of the unique *lachares*, which appears roughly along the area of transition between *athalia* and *norvegica*, and the geographical relations therefore suggest a transitional form from one subspecies to another. In my view this seems the most suitable taxonomic position for *lachares* and may explain the appearance of the exceptional features that are shown by this form.

Environmental variation of Mellicta athalia.

Variation of this type is extremely complicated in *athalia*, in fact it is difficult to find two series of specimens that are truly similar. The complexity is increased by the great range of individual variation that shows itself in every colony, and which makes the precise description of any given form almost impossible. Since the different modifications represent a continuous series varying in different directions, with the extremes connected by an infinite range of intermediate forms, it is not easy to decide how the situation can be presented. There is no recognised applicable method of nomenclature, and in the circumstances I propose to consider each principal cline in a general way. The ordinary range of modification can be covered by eight named forms, described below, but of course by this method the truly intermediate specimens cannot be placed except with the label *transit ad.* ... Since *athalia* and *celadussa* are identical in external features it is possible to consider their modifications together. On the other hand, *ambigua* almost always shows individual features, so the modifications are not identical with those of other subspecies. In this case, as with other species, I have retained the names commonly used for the subspecies. although I have indicated also the phase of *athalia* that will correspond. In this way I hope to emphasise the essential similarity of the modifications through different species and subspecies. The usual list of all named forms will be found on p. 42. The distribution of ecological variation within the species calls for some comment. The northern *norvegica* is very constant and appears to be insensitive to slight changes of environment. The other subspecies are most sensitive, but *M. athalia athalia*, *athalia celadussa* and *athalia ambigua* all react in the same way to produce what appear as identical modifications, which are not related to the subspecific groups. It follows that, in order to obtain a good picture of the environmental reactions, these must be considered alone without reference to subspecific characters. The modifications appear only on the upper surface ; I have not been able to detect any significant alteration in the pattern of the under surface, which seems to be remarkably constant.

A. *Forms of moderate size and normal markings. The typical form.*

Reverdin (1920) accepted as typical a form from the environs of Paris. Examples from this locality are of moderate or rather large size, the wing expanse of males around 35 mm. and of the females 37 mm. On the upper surface the black pattern is strongly marked and sometimes irregular, so that the general aspect is rather dark. British specimens from Kent appear to me indistinguishable from Parisian specimens, and this modification is found widely in north-western France with slight variation in size, and extends eastwards through Belgium and Holland, part of northern Switzerland, Germany, Austria and Czechoslovakia. Towards the east the pattern is often more regular, but the distinction is fine. In some localities there is a tendency towards smaller size and darker markings, grading into *noctula* Vorbrodt (p. 47). In parts of south-eastern Europe there appears further slight modification and many individuals show a very regular pattern and more tendency towards melanism, especially along the wing-margins (*scardona* Fruhst.). Such specimens are best considered as dark forms (*limera* Fruhst. p. 45). Another series most closely resembling typical *athalia* occurs in some damp southern localities, for example, along the Italian coast. The named forms include *melangraphata* Beuret, *rhodoleuca* Stauder, *obscura* Verity, etc. Such modifications may appear in quite localised colonies with paler forms (*tenuis* Verity) flying in a different biotope in the neighbourhood.

B. *Forms of small size and normal colour.*

M. athalia mod. *suessula* Fruhstorfer.

The small second-brood specimens that occur in many southern localities are commonly brightly coloured and tend towards the paler forms described as *tenuicula* Verity in section (E). Small forms of the first brood occur in many localities and under various conditions. The name *suessula* Fruhst. (1916), was given to small specimens which appear as a constant or racial form on the peat moors of Bavaria. I have a long series taken near the Schliersee and at Aschau in the Priental. In the male the fore wing measures 16 mm.–17 mm., with occasional specimens slightly larger or smaller, with rather heavily marked black pattern sometimes showing a tendency towards melanic shading at the wing-bases. It is scarcely possible to distinguish *suessula* from the small specimens that fly at a high altitude in the Engadin (*alpestris* Fruhst.) at the limit of the sub-alpine zone. Closely similar if not identical examples appear also in the Dolomites, where I have taken them at Misurina flying at around 5000 ft., and again with a strongly emphasised black pattern, giving quite a dark appearance (*orientalpicola* Verity). Another small form, described from the Mendel Pass (*microdelminia* Verity), which I have not seen in nature, is said to show more melanic shading at the wing-bases and will form a transition to *noctula* Fruhst., described in section (E). The small form described from Roumania by Hormuzaki as *fallax* should probably be united with *suessula*, but I have not seen specimens.

C. *Forms of large size and normal colour.*

M. athalia mod. *maxima* Turati, 1911.

In this instance my personal interpretation of the definition would include specimens with an expanse of 38 mm. or more and with a colouring of the upper

surface that is neither conspicuously pale nor really dark. Such specimens, always accompanied by smaller examples, occur in many widely separated localities, and typically in the Mehadia and other districts of Hungary and the Balkans. Large forms with similar facies are known from the Gironde (*vividior* Gouin), from Pau Wood, and from certain coastal districts in Italy (*maxima* Turati ; *obscura* Verity, etc.) in which the females especially are outstanding in size. Such large and florid specimens from eastern Europe are commonly placed as *mehadiensis* Gerhard, but this name was introduced for an aberration (see p. 100) and is not suitable for use in the present context. Of other names available I think that *maxima* Turati is most suitable.

d. *Brightly marked forms of moderate size.* (*The normal southern form*).

M. athalia mod. *luciflua* Fruhstorfer.

In most localities in southern Europe, on the southern slopes of the Alps, *athalia* is distinctly paler on the upper surface, compared with Parisian specimens, with the pattern more spread out and a brighter ground-colour. Such specimens from the Petit Salève were described by Fruhstorfer as *luciflua* (1917). I find it impossible to distinguish this form from several other named modifications that occur in similar climate, with slight variation in size but with the principal features essentially similar, e.g. *delminia* Fruhst. from Merano ; *pseudathalia* Reverdin if required ; *melida* Fruhst. from Lugano ; *tenuis* Verity from Florence, etc. All these names refer to forms of *celadussa* Fruhst., but a similar facies often appears among the south-eastern races of *athalia*. These grade into the large examples referred to above as *maxima* Turati, and often referred to *mehadiensis* Gerhard. Among other named forms which probably fall into this series may be mentioned *fiorii* Rocci from Venetia (1932), a name applied particularly to the second generation, and *benecensis* Verity (1940) from Monte Baldo. The typical series (Verity, 1940, Nos. 80, 81) shows a large form, probably from a moderate altitude. Specimens I have taken on the east slopes of the mountain, at over 4000 ft., are also bright but not so large. Similar bright forms appear over a wide area including the lowlands of Hungary, the Bukowina, much of Jugoslavia and even further east in places to Macedonia (Verity). It would be most difficult, perhaps impossible, to distinguish between examples of these forms without examining the locality labels. In peninsular Italy a confusing series of modifications appears. The normal southern form (*tenius* Verity) is usually equivalent to the brighter examples from the Alpes Maritimes. It is associated, on the one hand, with larger and darker examples referred above to the typical form and, on the other hand, and especially in the second brood, with much paler and smaller modifications that are described below. In northern Spain the distinction between mountain forms from the Asturias and forms flying at lower levels in Castile, Aragon, etc., is well marked. The former (*aranensis* de Sagarra) are quite similar to specimens I have from the Simplon district, taken at about 5000 ft., rather small with thick black markings and occasional lighter specimens. Further south the Spanish *athalia* show marked southern characters, equivalent on the Montseny to specimens of *luciflua* from the lower levels of the Alpes Maritimes. Elsewhere, e.g. in Aragon at Cuenca, the southern features appear even more prominently, with lighter black markings, and in the first brood the specimens are commonly large, with an expanse in the male of 34–38 mm.

The relatively large size of the specimens becomes very constant in the Sierra de Guadarrama (*hispanica* Wnukowsky). These specimens show the first indication of transition to the magnificent *biedermanni* Querci of north-western Spain and Portugal (see below).

E. *Pale forms of small size.*

M. athalia mod. *tenuicula* Verity.

Absence of melanic shading with a thin, clear-cut black pattern, is noticeable in most examples from southern Europe and from warm localities generally. In really dry habitats the ground-colour becomes lighter and the black pattern more delicate until the tone of the upper surface is definitely yellow instead of orange-brown. In most cases this development is associated with small size and it is most noticeable in the second generation. Only in the *athalia* of the Sierra Nevada have I seen such specimens of normal size (*nevadensis* Oberthür p. 27). Small examples modified in this way appear especially in Italy in the second generation, and have been named several times. These forms include *hastensis* Rocci (1932) from the Ligurian Appennines, with the still smaller *pusilla* Rocci as the second generation, in which the males expand only 27–30 mm. Other named forms which display the modification in varying degrees and all of the second generation are *fiorii* Rocci (1930) from Palmanova ; *partheniae-similis* Rocci and *postdivergens* Rocci (1930) from Lombardy, both attributed to the second generation of *athalia divergens* Rocci ; *tenuicula* Verity (1919) from Bolognola, etc. The last name, which appears to have several years' priority, may be accepted as most suitable for these small and pale modifications. In its full development as it appears near Bolognola in the Italian Marches this is a most striking form. There are good figures given by Verity (1940, Pl. 2, figs. 37–39), but these do not show up the yellow-orange ground-colour of a tone even paler than typical *deione* Geyer.

F. *Pale forms of large size.*

M. athalia mod. *biedermanni* Querci.

Very large examples with marked " dry form " features appear in Portugal, with a wing-expanse of 37 mm.–41 mm. in the males and up to 46 mm. in females. This remarkable form, named *biedermanni* by Querci, is restricted to Portugal and north-western Spain, and is quite unlike anything else that occurs in Europe. The wings are wide and ample, the ground-colour on the upper surface is pale with thin black markings, but the discal macules often show a conspicuous expanded black macule in cellule 1b of the fore wing. I have seen typical specimens only from the Sierra de Estrela in central Portugal. Examples, taken by Chapman around Casayo in Galicia were also very large, but those I have seen were not so pale. Chapman remarks upon their variability and reported specimens (? females) with a maximum wing-expanse of 52 mm. This form is of special interest as it resembles so closely the very large *niphona* Butler of the sub-species *ambigua*, well-known from Japan, Korea and the lower Amur. Even paler examples, with greatly reduced black pattern, occur in Sutschan, presumably in exceptionally dry habitats. Material and data from this region are scarcely adequate, but so far as it goes it suggests that the transition from the small dark modifications of the central Siberian mountains to the large pale forms flying further east near the sea is just as well shown in

Siberia as it is in Europe, and if allowance is made for a subspecific difference, the modifications seen are truly identical. Good figures of *biedermanni* are given by Verity (1940, Pl. 2, fig. 26, 27). (*N.B.*—The figs. 28 and 29 recorded as *iberanana* gen. 2 are referable to *deione* Geyer gen. 2.)

c. *Very dark forms, usually small.*

M. athalia mod. *noctula* Vorbrodt.

A marked tendency to melanism, especially in the male, is quite common in cold or damp habitats, and many striking modifications in this direction have been named. In such specimens, with marked melanism, the black pattern is diffused, with diminution in size of the orange macules, a dark suffusion spreads from the wing-bases and the hind wing is often entirely black with the exception of the orange submarginal macules. This appearance is exactly similar to the hind wing of ab. *aphaea* Hübner. In such races, the ground-colour of the upper surface is often rather pale. In most cases the melanism is not constant and normal examples will be found in an unselected series. This development was first recorded by Staudinger in 1871, who named *caucasica* very dark specimens of *athalia* from the Caucasus. This name is invalid by modern rules of nomenclature. The next distinction was made by Hormuzaki, who described as *dictynnoides* (1898) a dark *Melitaea* from Roumania. This name is not satisfactory, although probably referable to *athalia*. Unfortunately, it is not possible today to determine with certainty to what species it really applies. Rather small dark specimens from Glarus in northern Switzerland were named again by Vorbrodt in 1917 as *noctula*. The holotype figured by Verity (1940, No. 215) is still preserved in the Fruhstorfer Coll. at Paris. The name may safely be used for melanic modifications, although the form from Glarus is not so extreme as that, for example, from Borjom in the central Caucasus. These dark forms have been named again by several authors, e.g. *borjoma* Fruhstorfer, 1917, an extremely dark form from Saratow in southern Russia, *pseudodictynna* Strauder, 1922, from the Salzkammergut : *parvanigra* Verity, 1940, from Holland. This is figured by Verity (1940, Nos. 108, 109) and is quite unlike examples from Holland in my own collection, which do not show any trace of melanism. In eastern Siberia the situation is similar. Very dark forms are recorded from around Lake Baical by Fruhstorfer as *tinica* 1910, and the small modification *kentensa* Seitz (which I regard as synonymous with typical *athalia*) that flies in the Sajan Mts. is also very dark. Further east as the extreme continental climate becomes modified the melanic tendency rapidly disappears. It is clear that the melanic modifications are common throughout the colder districts of Europe and Asia : e.g. Dioszeghy (1930) remarks that in the Retyezat district of Hungary melanic examples are most frequent and typical specimens " scarcely occur." It seems most doubtful to me whether it is possible to maintain any taxonomic distinction between the various forms described. In all cases just mentioned the melanism is associated with small size.

d. *Dark forms of large size.*

M. athalia mod. *satyra* mod. n. Pl. I, fig. 19. Holotype ♂ and 17 paratypes in my collection.

Most dark forms are also small and it is evident that the same factors react to produce both features. The only large and dark examples that I have seen were taken by myself at Karlovo in the Balkan Mts. The series of 30 examples is variable, but in nearly all there is marked melanism on the upper surface. There is a black shade at the wing bases. On the fore wings this reaches along the inner-margin to the anal angle ; on the hind wings it invades the basal half of the wing.

The longitudinal black nervures are extended into wider stripes that almost obliterate the orange macules on the fore wings and the cell is filled with black scales, except for a single orange oval macule proximal to the discocellular nervure. On the under surface of the fore wing the standard series of macules are clearly indicated. The wing-expanse in the males varies from 36 mm.–41 mm. ; in females 40 mm.–42 mm.

I regard this as a luxuriant race of *limera* Fruhst.

The following forms of *Mellicta athalia* have been described and named :

alba *Melitaea athalia* ab. *alba* Rehfous, 1905. See p. 95.

alpestris *Melitaea athalia* form *alpestris* Vorbrodt, 1928, *Iris* **42** : 21. Loc. Riffelalp, Switzerland. A small mountain form with heavy black pattern. Flies up to 2000 m. This name is employed first for *M. dictynna alpestris* Fruhst., 1916, to indicate a similar high-level modification.

ambigua *Melitaea athalia* var. *ambigua* Ménétriés, 1859, Schrenk, *Reisen und Forschungen in Amurland* : 24, Pl. 2 fig. 4. Loc. Djai; Amur. A subspecies. See p. 28.

anatolica *Melitaea athalia anatolica* Wagner, 1929, *Mitt. munch. ent. Ges.* **19** : 22. Loc. Sultan Dagh, Anatolia at 1500 m. On the supper surface the black margin of both wings is wide and the submarginal lunules are absent. The under surface is darker. Perhaps a micro-subspecies. Pls. I, II, fig. 16.

aphaea *Papilio aphaea* Hubner, 1814–1816. See p. 96.

aquilari *Melitaea helvetica* race *aquilari* Sagarra, Querci nec Sagarra, 1932, *Mus. barcin. Sci. nat. Op.* **16** : 128. *Nomen nudum.* Probably an error, perhaps a MS name and never published.

aranensis *Melitaea helvetica aranensis* de Sagarra, 1930 (1931), *Butll. Inst. catal. Hist. nat.* (2) **10** : 115. Loc. Val d'Aràn, Salardu. The holotype, a male from Banys-de-Tredòs is in the Mus. de Cataluna, Barcelona. The ground-colour is pale with heavy black pattern and dark suffusion. Occurs in the valleys of the Pyrenees at high altitudes. Taken 23.vii and 1.viii, 1922. A good series in my collection is not distinguishable from examples from many subalpine localities, e.g. Berisal, on the Simplon; Interlaken district; etc.

asiae *Melitaea athalia asiae* Verity, 1940, *Trans. R. ent. Soc. Lond.* **91** : 612. Loc. Sutschan. Holotype in Coll. Verity. Fig. Verity 1940, Nos. 21–24. The specimens were received from Rutimeyer of Berne, said to come from Sutschan. In facies and genitalia appears quite typical of southern Swiss examples of *celadussa*. The locality cannot be accepted without confirmation.

asiaefrigida *Melitaea athalia* form *asiaefrigida* Verity, 1940. *Trans. R. ent. Soc. Lond.* **91** : 613. Loc. " Southern Siberia " ex Coll. Bartel. This is a melanic form of *pseudathalia* and from the genitalia should be of European origin. The data are not convincing. Named from a single specimen. Fig. Verity 1940, No. 25.

asteriades *Melitaea athalia* var. *asteriades* de Selys, 1857. See p. 96.

aterrimevittata *Melitaea athalia* form *aterrimevittata* Verity, 1920. See p. 96.

athalides *Melitaea athalides* Verity, 1919, *Ent. Rec.* **31** : 194. Loc. Sibillini Mts. Presumed hybrid between *athalia* and *varia*. The anal portion of the hind wings is entirely light fulvous and the fore wings are well marked on the under surface. Not mentioned by Verity 1940.

athalioides *Melitaea athalia athalioides* Turati & Verity, 1911, *Boll. Soc. ent. ital.* **42** : 208. Loc. Valdieri, Piedmont. The colour on the upper surface is of a darker tone than usual and approaches *diamina* Lang (*dictynna* Esp.). Said to form a " passage " between the two species.

atro-vittata *Melitaea athalia* form *atro-vittata* Turati & Verity, 1911, *Boll. Soc. ent. ital.* **42** : 209. See p. 96.

bathilda *Melitaea athalia bathilda* Fruhstorfer, 1919, *Arch. Naturgesch.* **83** (A) (3) : 179. Loc. Radde, Amur. Referable to subsp. *ambigua* Ménétr. A bright form of moderate size. The holotype is figured by Verity 1940, No. 207, from the specimen in Coll. Fruhstorfer at Paris.

benecensis *Melitaea athalia benecensis* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 627. Loc. Monte Baldo. A large pale " dry " form probably from a low elevation. My specimens from the eastern slopes of the mountain are not larger than usual. Fig. Verity 1940, No. 80–81.

biedermanni *Melitaea athalia biedermanni* Querci, 1932, *Mus. barcin. Sci. nat. Op.* **16** : 128. Loc. Sierra de Estrela, Portugal. The upper surface is pale with thin markings. The largest European race (see p. 40). Holotype from Covilha (1st gen.) now in the Mus. de Cataluna at Barcelona. Fig. Verity 1940, No. 26–27.

bifasciata *Melitaea athalia* ab. *bifasciata* Reverdin, 1914. See p. 96.

borealis *Melitaea athalia borealis* Lindstrom, 1929, *Ent. Tidskr.* **50** : 226. Nom. nov. pro *M. athalia* var. *parthenie* Auriv. See p. 33. Synonym of *norvegica* Stgr.

boris *Melitaea athalia boris* Fruhstorfer, 1917, *Soc. ent.* **32** : 19. Loc. Bulgaria, Rhodope Mts. A large pale modification. The ♀ holotype in Coll. Fruhstorfer at Paris. Fig. Verity 1940, No. 33, holotype.

britanna *Melitaea athalia* race *britanna* Verity, 1913, *Boll. Soc. ent. ital.* **45** : 210. Loc. Tavistock, England. A large modification with a marked tendency to melanism. Fig. Verity 1940, No. 110–111. The genitalia figure (303) is not accurate, but shows the genitalia of *britomartis* and it is clear that there has been a confusion of labels. The genitalia of all British *athalia* that I have examined have been entirely similar to normal specimens from other localities in north-western Europe.

caucasica *Melitaea athalia* var. *caucasica* Staudinger, 1871, *Cat.* (Ed. 2) : 19. Loc. Armenia. A small dark form. The name is preoccupied by *M. didyma caucasica* Stgr., 1861. See *caucasogenita* Verity, 1930.

caucasogenita *Melitaea athalia* var. *caucasogenita* Verity, 1930, *Ent. Rec.* **42** : 134. Nom. nov. pro *athalia caucasica* Stgr., 1871.

celadussa *Melitaea athalia celadussa* Fruhstorfer, 1910, *Soc. ent.* **25** : 51. Loc. Tenda, Alpes Maritimes, France. The name was applied to the brightly-coloured form of moderate size that occurs in the southern Alps. Ten years later Reverdin detected the marked differences in the male genitalia that exist between the northern and south-western specimens of *athalia*. Since *celadussa* is the earliest named racial form that is indisputably referable to the south-western subspecies (*pseudathalia* Reverdin) it must be adopted as the subspecific name, although Fruhstorfer was clearly describing an ecological modification only.

cinnamomea *Melitaea athalia* ab. *cinnamomea* Vorbrodt, 1916. See p. 96.

cinxio-dictynnoides *Melitaea athalia* form *cinxio-dictynnoides* H. Stauder, 1922. See p. 96.

commacula *Melitaea athalia* ab. *commacula* Caruel, 1944. See p. 97.

conica *Melitaea athalia conica* Matsumura, 1928, *Ins. Mats.* **3** : 155. Loc. North Korea. Described from a single dark female. This is probably a form of *athalia ambigua* Ménétr.

corythalia *Papilio corythalia* Hübner, 1790. See p. 97, 106.

crassipicta *Melitaea ambigua* form *crassipicta* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 600. Loc. Altai. The male holotype should be in Coll. Brit. Mus. (Nat. Hist.), but cannot now be traced. The preparation of genitalia is not good, but there may be an approach to *ambigua* in the tegumen, while the posterior process of the clasp shows a typical *athalia* form. This is best placed as an intermediate specimen. Externally it shows an ordinary dark form probably from a mountainous locality. Fig. Verity 1940, No. 11 and genitalia No. 260.

csikii *Melitaea athalia* ab. *csikii* Aigner-Abafi, 1906. See p. 97.

cymothoe *Papilio cymothoe* Bertolini, 1829. See p. 97.

dejonides *Melitaea athalia* subsp. *dejonides* Wagner, 1918. *Z. öst. EntVer.* **3** : 12. Loc. Ploesti, Roumania. A small form said to resemble *deione* Geyer, with pale ground-colour. Dissection showed *athalia*. Series of 5♂ and 3♀. Identity not certain, perhaps *britomartis*.

dejoneformis *Melitaea athalia* var. *dejoneformis* Verity, 1914, *Boll. Soc. ent. ital.* **45** : 208. Nom. nov. pro *nevadensis* Oberthür, 1904, said to be preoccupied by *parthenie nevadensis* Spuler, 1908. Later (1940) Verity followed Turati in restricting the name to a pale form from the Mainarde Mts. of central Italy. This later action is invalid. In Verity, 1940, the name is spelt *deioneformis*.

delminia *Melitaea athalia delminia* Fruhstorfer, 1910, *Soc. ent.* **25** : 51. Loc. Klausen, South Tirol. A bright form of moderate size. Rocci (1932) states that this = *pseudathalia*.

diaminoides *Melitaea athalia* race *diaminoides* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 635. Loc. Transsylvania and Bukowina, etc. Proposed as nom. nov. pro *athalia dictynnoides* Fruhstorfer nec *aurelia dictynnoides* Hormuzaki, 1898. Since Hormuzaki decided in 1934 that his *dictynnoides* was attributable to *athalia* and not to *aurelia*, the need for a new name is not obvious. Fruhstorfer (1917) referred his *dictynnoides* to Hormuzaki.

dictynnoides *Melitaea aurelia* var. *dictynnoides* Hormuzaki, 1898, *Iris* **11** : 2. A rather small dark form from the Bukowina. Referred to *athalia* by Hormuzaki in 1911 (*Z. wiss. InsektBiol.* **7** : 214) and transferred to *britomartis* in 1934 (*Bol. Fac. Stiinte Cern.* **8** : 62). Unfortunately it is difficult to place *dictynnoides* with certainty, as data given by Hormuzaki are not sufficient.

divergens *Melitaea helvetica* race *divergens* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184. Loc. Lombardy. First generation. Fig. Verity 1940, Nos. 48–49. A bright and well-marked form, difficult to separate from *luciflua* Fruhst. and *delminia* Fruhst.

dorfmeisteri *Melitaea athalia* ab. *dorfmeisteri* Hellweger, 1911. See p. 97.

eos *Papilio eos* Haworth, 1803. See p. 97, 106.

evittata *Melitaea helvetica* ab. *evittata* Storace, 1943, *Mem. Soc. ent. ital.* **22** : 79. Loc. Italy. See p. 98.

evittata *Melitaea athalia* form *evittata* Verity, 1916, *Boll. Soc. ent. ital.* **48** : 187. A name for two aberrant males in which the discal fascia on the upper surface of the forewings is scarcely indicated by a few small black macules. This form is the opposite of *atro-vittata* Verity and approaches *pyronia* Hübner.

fallax *Melitaeaathalia* ab. *fallax* Hormuzaki, 1925, *N. Beitr. syst. Insektenk.* **3** : 70. Loc. Aschau, Austria. Very small form resembling *aurelia* Nick. Hormuzaki checked the genitalia and found *athalia*. Perhaps identical with *suessula* Fruhst., of which I have taken characteristic examples in this locality.

fennica *Melitaea athalia* ab. *fennica* E. Reuter, 1893. See p. 98.

fennica *Melitaea athalia* var. *fennica* Petersen, 1947, *Zool. Bidr. Uppsala* **26** : 375. Loc. Norway—Opland ; Finland. A small dark form, not quite so extreme as *norvegica* Auriv., but the description scarcely gives definite characters. It is chiefly based upon measurements to correspond with a determined isophene, and is used in a subspecific sense.

flaveo-elongata *Melitaea athalia* ab. *flaveo-elongata* Caruel, 1944. See p. 98.

flavescens *Melitaea athalia* ab. *flavescens* Matsumura, 1928. See p. 98.

fulla *Papilio fulla* Quensel, 1791. See p. 98, 107.

funesta *Melitaea athalia* form *funesta* Stauder, 1922. See p. 98.

hastensis *Melitaea athalia* form *hastensis* Rocci, 1932, *Mem. Soc. ent. ital.* **10** : 208. Monferrato—Piedmont. (Types from Asti.) A very small pale form with thin markings.

helvetica *Melitaea athalia* var. *helvetica* Rühl, 1888. For consideration of this difficult name see p. 111.

hertha *Papilio hertha* Quensel, 1791. See p. 98, 105.

hisopa *Melitaea athalia* var. *hisopa* de Selys-Longchamps, 1837. See p. 99.

hispanica *Melitaea athalia hispanica* Wnukowsky, 1929, *Zool. Anz.* **83** : 222. Nom. nov. pro *athalia iberica* Staudinger, 1901 nec *aurinia iberica* Oberthür 1881.

iberagigas *Melitaea athalia iberagigas* Verity, 1930, *Ent. Rec.* **42** : 134. Nom. nov. pro *iberica* Stgr., 1901, nec Oberthür, 1881. Synonym of *hispanica* Wnukowsky.

iberanana *Melitaea athalia iberanana* Verity, 1930, *Ent. Rec.* **42** : 135. Loc. Portugal. This form can be identified from figures given by Verity 1940, Nos. 28–29, 270, which show small *deione* Geyer. See p. 58.

iberica *Melitaea athalia* var. *iberica* Staudinger, 1901. Loc. " Hisp. Lusit". A rather pale form with wide ample wings and of large size. The holotype, now preserved in Coll. Staudinger, came from San Ildefonso in the Sierra de Guadarrama (*teste* Dr. Hering). The name is a primary homonym of *iberica* Oberthür, 1881. See *hispanica* Wnu.

illyrica *Melitaea athalia illyrica* H. Stauder, 1914. See p. 99.

indigua *Melitaea athalia* ab. *indigua* Cabeau, 1922. See p. 99.

lachares *Melitaea athalia lachares* Fruhstorfer, 1919. *Arch. Naturgesch.* **83** (A) (3) : 167. Loc. Stockholm, Sweden ; Norway ; Finland ; Estland, Prussia (Königsburg). A small form, rather pale, with the bands on the under surface of the hind wings narrow. The holotype is now in the Mus. nat. Hist. nat., Paris, and is figured by Verity 1940, No. 225. See p. 35.

lepontica *Melitaea pseudathalia* subsp.n. *lepontica* Rutimeyer, 1943, *Mitt. schweiz. ent. Ges.* **19** : 30. Loc. Val Verzasca, Val Bevona, etc. A large and brightly marked race, said to be larger and slightly darker than *luciflua* Fruhst.

leucippe *Papilio leucippe* Schneider, 1789. See p. 99.

leucophana *Melitaea athalia* ab. *leucophana* Cabeau, 1912. See p. 99.

ligata *Melitaea athalia* ab. *ligata* Caruel, 1944. See p. 99.

limera *Melitaea athalia limera* Fruhstorfer, 1916 (1917). *Arch. Naturgesch.* **82** (A) (2) : 3. Loc. Koricna, Bosnia. A small dark form. The female holotype and 3 paratypes figured by Verity 1940, Nos. 231 ; 229, 230, 232, from specimens preserved in Mus. nat. Hist. nat, Paris, in Coll. Fruhstorfer.

limera-parthenoidemima *Melitaea athalia* race *limera-parthenoidemima* Verity, 1939, *Ent. Rec.* **51** (Suppl). : 18. Loc. Skala, Greece. A race of *parthenoidemima* Verity including many examples transitional to *limera* Fruhstorfer. Not figured by Verity 1940.

luciflua *Melitaea athalia luciflua* Fruhstorfer, 1916 (1917). *Arch. Naturgesch.* **82** (A) (2) : 5. Loc. Petit Salève, Savoie. A brightly marked southern form of *celadussa*, with thin black pattern. Fig. Verity 1940, Nos. 53–56,

lucifuga *Melitaea athalia lucifuga* Fruhstorfer, 1916 (1917). *Arch. Naturgesch.* **82** (A) (2) : 4. Loc. Saratow. A small dark form of typical *athalia*. Holotype in Coll. Fruhstorfer in Mus. nat. Hist. nat., Paris. Figured by Verity 1940, No. 222, and paratypes 223, 224. In southern Russia the species *athalia*, *aurelia* and *britomartis* are usually dark, they often fly together and a dissection is needed to separate them.

mandschurica *Melitaea athalia* var. *mandschurica* Fixsen, 1887, Romanoff *Mém. Lép.* **3** : 302. Loc. Korea. The very large eastern form of the subspecies *ambigua* Ménétr. Probably a true synonym of *niphona* Butler, 1878.

maxima *Melitaea athalia maxima* Turati, 1911, *Ann. Mus. Univ. Napoli* **3** : 19. Loc. Paola, Calabria and Isle of Elba. A large and rather dark form. Figured by H. Stauder 1914, *Z. wiss. InsektBiol.* **10** : 374, Pl. 2. From Cucuzzo. Holotype not traced.

maximaeformis *Melitaea helvetica divergens* form *maximaeformis* Rocci, 1930. *Boll. Soc. ent. ital.* **62** : 184, and (fig.) 1931, *Mem. Soc. ent. ital.* **10** : 25. Pl. 3, fig. 4–7. This appears to be a name for the largest examples of the variable race *divergens* Rocci. Occurs along the Ticino with *britomartis*.

mehadiensis *Melitaea athalia* var. *mehadiensis* Gerhard, 1882. See p. 100.

melangraphata *Melitaea helvetica melangraphata* Beuret, 1932, *Mitt. schweiz. ent. Ges.* **15** : 451 and figs. Loc. Canaria Valley and Fusio, Switzerland. The black markings on the upper surface are well developed, often with a broad discal band and wide black wing-margins.

melida *Melitaea athalia melida* Fruhstorfer, 1919, *Arch. Naturgesch.* **83** (A) (3) : 182. Loc. Lugano, Switzerland. The ground-colour on the upper surface is pale and the black markings thin, and sometimes partly obsolete. Fruhstorfer says this form is found only upon Monte Generoso and Monte Lema.

microdelminia *Melitaea athalia* race *microdelminia* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 628, figs. 82, 83. A small dark mountain race from the Mendola Pass. Verity suggests also that it may occur at Trafoi and Campiglio. Perhaps scarcely separable from *alpestris* Fruhst. and *suessula* Fruhst.

mirabilis *Melitaea athalia* form *mirabilis* Fernandez, 1929. See p. 100.

mirefasciata *Melitaea athalia* ab. *mirefasciata* Cabeau, 1923. See p. 100.

mixtaceladussa *Melitaea athalia* race *mixtaceladussa* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 625. Loc. Gèdre, Pyrenees. This form is said to differ from *celadussa* in showing a small sub-uncus in the male. I have shown (Higgins, 1938) that this is the case in some examples but not in all.

mixtalpicola *Melitaea athalia* race *mixtalpicola* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 625. Loc. Pontresina, Engadin. This is said to consist of a mixture of race *helvetica* Rühl and race *orientalpicola* Verity. The male holotype in Coll. Verity.

navarina *Melitaea athalia* ab. *navarina* de Selys-Longchamps, 1837. See p. 100, 105.

nevadensis *Melitaea deione nevadensis* Oberthür, 1904, *Ét. Lép. comp.* **1** : 2, figs. 355–358. Loc. Lanjaron, Sierra Nevada. A large pale form of *celadussa* with unusual markings. The male holotype in Coll. Brit. Mus. (Nat. Hist.). Attributed in error to *deione* by Oberthür when first described, but referred correctly to *athalia* in *loc. cit.* **3** : 251. In several features it does not conform to the normal clines of the species. Perhaps it should be regarded as a Mauritanian element. See p. 27.

nigrathalia *Melitaea athalia* ab. *nigrathalia* Johnstone, 1944. See p. 100.

nigrobella *Melitaea athalia* forma *nigrobella* Rocci, 1942, *Boll. Soc. ent. ital.* **74** : 131. Loc. Sappada in Val Degano. Distinguished by the small size and tendency to melanism. See *orientalpicola* Verity, probably synonymous.

noctula *Melitaea athalia noctula* Vorbrodt (Fruhstorfer *in litt.*), 1917. *Mitt. schweiz. ent. Ges.* **12** : 436. Loc. Glärnisch, Switzerland. A small dark form of the high mountains. The holotype is in the Mus. nat. Hist. nat., Paris: figured by Verity 1940, No. 215, and labelled Erstfeld Valley (*teste* Verity.)

norvegica *Melitaea athalia* var. *norvegica* Aurivillius, 1888. *Nord. Fjaril.* : 30. The name was given to certain very small and pale examples from Dovre. The usual mountain form of Norway was included by Aurivillius as *parthenie* Borkhausen (i.e. *aurelia* Nickerl). See p. 33.

nossis *Melitaea athalia nossis* Fruhstorfer, 1919. *Arch. Naturgesch.* **83** (A) (3) : 180. Loc. Nagasaki, Japan. The holotype now preserved in the Mus. nat. Hist. nat., Paris, in Coll. Fruhstorfer is figured by Verity 1940, No. 209. This shows an ordinary example of *ambigua* near *niphona*, and as such it is placed by Verity.

obscura *Melitaea athalia* race *obscura* Verity, 1919. *Ent. Rec.* **31** : 194. Loc. Lepreonotte, Italy. Said to be larger than *deuoneformis* with deeper ground-colour and thicker black pattern. It is not illustrated by Verity 1940.

obscura-maxima *Melitaea athalia* race *obscura-maxima* Verity, 1921. *Ent. Rec.* **33** : 213. Loc. San Fili, Calabria. Specimens transitional to *maxima* Turati, but showing some characters of *obscura* Verity from high elevations.

obsoleta *Melitaea athalia* ab. *obsoleta* Tutt, 1896. See p. 101.

orientalpicola *Melitaea athalia* race *orientalpicola* Verity, 1940. *Trans. R. ent. Soc. Lond.* **89** : 333. Loc. Sagoada, Carnic Alps. A small, dark mountain race, flying at 4500 ft. See also *microdelminia* Verity, *nigrobella* Rocci, *pseudodictynna* Staudinger. Fig. Verity 1940, No. 91–93.

paleatincta *Melitaea athalia* form *paleatincta* Verity, 1913. See p. 101.

parnassiotropa *Melitaea athalia parnassiotropa* Bryk, 1923. See p. 101.

partheniaesimilis *Melitaea helvetica divergens* forma *partheniaesimilis* Rocci, 1930. *Boll. Soc. ent. ital.* **62** : 134. Loc. Lombardy and (figs.) 1931. *Mem. Soc. ent. ital.* **10** : 26. Very small and pale specimens. A name for "the second emergence of the second generation of *athalia divergens*". See p. 94.

parthenides *Melitaea parthenides* Verity, 1919. See p. 101.

parthenodemima *Melitaea athalia* race *parthenodemima* Verity, 1939. *Ent. Rec.* **52** Suppl. : 12. Loc. Balkans, Rilo Dagh. etc. A large and pale form, but with thicker black markings on the upper surface. Fig. Verity 1940, Nos. 94–95. See also *limera* Fruhst.

parthenopsis *Melitaea athalia* var. *parthenopsis* Hormuzaki, 1925. *N. Beitr. syst. Insectenk.* **3** : 71, and figures of genitalia. The harpe is said not to show any teeth. This should belong to *athalia* by the genitalia, but I cannot identify it further. The specimens are said to resemble *aurelia* Nickerl, rather pale on the upper surface. Found at Ahornbuhl, Austria.

parvahispanica Verity. See under *britomartis* p. 70.

parvanigra *Melitaea athalia* race *parvanigra* Verity, 1940. *Trans. R. ent. Soc. Lond.* **89** : 344. Loc. Bywank, Holland. A very melanic form of moderate size. Fig. Verity 1940, Nos. 108–109. Holotype in Coll. Verity.

permista *Melitaea athalia permista* H. Staudinger, 1922. See p. 101.

phyciodina *Melitaea athalia* ab. *phyciodina* Hormuzaki, 1934. See p. 101.

polaris *Melitaea athalia* var. *polaris* Sparre-Schneider, 1921. *Tromsø. Mus. Aarsh.* **44** : 2 : 16. Loc. Malselven. This is *nomen nudum*. In any case it is invalid, as it falls as a primary homonym to *M. dodyma polaris* Groum, 1899.

polynome *Papilio polynome* Schneider, 1785. A name for *P. maturna* figured by Piller & Mitterpacher, Pl. 5 figs. 1, 2. Loc. Slavonia. A large luxuriant race, probably equivalent to *athalia scardona* Fruhstorfer.

postdivergens *Melitaea athalia* form *postdivergens* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184. A small pale form, but with moderately heavy black pattern. The " first appearance of the second generation in Lombardy". See *divergens* Rocci.

postmelangraphata *Melitaea athalia* ex. *helvetica* race *melangraphata* gen. 2, *postmelangraphata* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 622. Loc. Vanzone. Holotype in Coll. Verity. A name for the smaller second generation.

postmelida *Melitaea athalia* ex. *helvetica* race *melida* gen. 2 *postmelida* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 621. A " dry somation " from Monte Generoso. Smaller than the first generation.

postsubluciflua *Melitaea athalia* race *subluciflua* form *postsubluciflua* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 620. Loc. Vence, Southern France. A name for the small, pale second generation of this district.

postvividior *Melitaea athalia vividior* gen. 2 *postvividior* Verity, 1930, *Ent. Rec.* **42** : 132. Loc. Gironde, Southern France. A name for the small second generation that is said to show a " duller " ground-colour on the upper surface.

progressiva *Melitaea athalia* ab. *progressiva* Ksienschoppolsky, 1912. *Trud. Obshch. Izsl. Volyni* **8** : 38. and figure. I have not been able to check this reference.

pseudathalia *Melitaea pseudathalia* Reverdin, 1921, *Bull. Soc. ent. Fr.* **1920** : 319. Loc. France : Htes. Pyrénées ; Pyrénées Or. ; Bouches du Rhône ; Var ; Basses Alpes. Switzerland : Cantons of Geneva ; Vaud ; Valais ; Berne ; Uri ; Tessin. Italy : North, central and south. Spain. In this paper the characters of the male genitalia of the south-western subspecies of *athalia* are described and this form is named *pseudathalia*. The Parisian form of *athalia* is specified as typical, but no specimen is designated holotype of the new form, and specification of a lectotype is clearly required. Verity's reference to Tramelan as " type locality " (Verity 1940 : 625) cannot stand, as this locality was not mentioned by Reverdin in his original description. It is obvious, too, that such a specification would not be in keeping with Reverdin's intended application of the name, since the *athalia* population of Tramelan is composed largely of intermediate forms. I made some enquiries at Geneva where Reverdin's collection is preserved, and I discovered that Dr. Beuret has lately made a careful examination of all the preparations of *pseudathalia* for the purpose of specifying a lectotype. He has chosen the specimen and preparation No. 6267, taken at Versoix (Geneva) on 6th June, 1920, which we may suppose formed part of Reverdin's original series. Dr. Beuret intends to announce this specification in a paper, now in the press, to be published shortly in the *Mitt. ent. Ges. Basel.* He has been good enough to inform me by letter of his researches so that a reference to his decision can be included in this paper. In consequence of this action it seems probable that *pseudathalia* Rev., 1921, should be considered a true synonym of *celadussa* Fruhst. for the south-western subspecies of *athalia*, but the name is valid and available if required.

pseudodictynna *Melitaea athalia pseudodictynna* Stauder, 1922, *Ent. Anz.* **2** : 30. Loc. Hallstadt in Salzkammergut. Very dark specimens closely resembling *dictynna*. The whereabouts of the holotype is not stated.

punctifera *Melitaea athalia* ab. *punctifera* Verity, 1913. See p. 102.

pusilla *Melitaea helvetica* race *pusilla* Rocci, 1932. *Mem. Soc. ent. ital.* **10** : 209. Loc. Val Bisogno, Val Scrivia, Liguria. Near *hastensis* Rocci. A name for the second generation of *athalia* from the Ligurian Appennines. It is small and fragile, with the ground-colour on the upper surface pale straw colour. the black pattern heavy. There is always a clear wide post-discal space.

pygmaea *Melitaea athalia* var. *pygmaea* Hormuzaki, 1923. See p. 70 under *britomartis*.

pyronia *Papilio pyronia* Hübner, 1804. See pp. 102, 106.

retyezatica *Melitaea athalia* form *retyezatica* Dioszeghy, 1930. *Verh. siebenburg. Ver. Naturw.* **79 80** : 212, Pl. 2, figs. 1, 2. A rather small form, with regular heavy markings. The marginal border on the upper surface is widely black. The figure shows a form very near *suessula* Fruhst., but with more melanic shading. See *pseudodictynna* Stauder.

rhodoleuca *Melitaea athalia* form *rhodoleuca* Stauder, 1914. *Z. wiss. InsektBiol.* **10** : 374. Loc. San Fili Cosenza, Southern Italy (figures). A large form with paler ground-colour than *maxima* Turati. The whereabouts of the holotype is not known. According to Verity (1940 : 617) the name was given to a single aberrant specimen, but this is not stated in the description. It appears that this name should be used for *obscura-maxima* Verity (*See* Hemming *in* Verity 1940 : 691).

sachalinensis *Melitaea athalia* ssp. *sachalinensis* Matsumura, 1925, *J. Coll. Agric. Sapporo*, **15** : 99, Loc. Saghalien. Identification uncertain.

samonica *Melitaea athalia* var. *samonica* Riesen, 1891. See p. 102.

sajanskalpina *Melitaea ambigua* race *sajanskalpina* Verity, 1940. *Trans. R. ent. Soc. Lond.* **89** : 600. Loc. Chulugaischa, Mondy, Sajan Turkinsk White Mts., Sajan. Holotype ♂ from Chulugaischa in Coll. Verity. A small mountain form with marked melanic suffusion. Probably a synonym of *kenteana* Seitz, but in the case of a female specimen it is scarcely possible to make a certain diagnosis. Fig. Verity 1940, No. 13–15. Doubtfully distinct from nominotypical *ambigua* Ménétr.

scandinavica *Melitaea aurelia* var. *scandinavica* Staudinger, 1892. *Iris* **5** : 327. Loc. Dovre, Norway. Synonym of *athalia norvegica* Auriv. *q.v.*

scardona *Melitaea athalia scardona* Fruhstorfer, 1910, *Soc. ent.* **25** : 51. Loc. Agram. A large form on the dark side, otherwise normal. Holotype in Coll. Fruhstorfer, in Mus. nat. Hist. nat., Paris. Figs. Verity 1940, No. 227 (holotype) ; 228 paratype.

semiradiata *Melitaea athalia semiradiata* Turati & Verity, 1912. See p. 102.

sicula *Melitaea athalia* var. *sicula* Turati, 1915. *Atti Soc. ital. Sci. nat.* **53** : 600. Loc. Ficuzza, Sicily. Named from females only. These show a dusting of black scales as in *parthenoides* Keferst. The males show somewhat reduced thin black markings.

siculapinguis *Melitaea athalia* " exerge " *helvetica* race *siculapinguis* Verity, 1950, *Le Farfalle* Pl. 45, Nos. 14, 15. Larger than *sicula* and near *obscura* Trti., but with the black pattern less thick. Loc. Zapulla near Messina.

sohana *Melitaea athalia* ab. *sohana* Cabeau, 1922. See p. 103.

spadana *Melitaea athalia* ab. *spadana* Cabeau, 1922. See p. 103.

subhelvetica *Melitaea athalia* race *subhelvetica* Verity, 1935, *Ent. Rec.* **47** (Suppl.) : 76. Loc. Lotschtal, Platten, etc., Switzerland. Small specimens with a rich orange ground-colour and clear thin markings. Probably a synonym of *alpestris* and valid for use if required.

sublucifjua *Melitaea athalia* race *sublucifjua* Verity, 1935. *Ent. Rec.* **47** (Suppl.) : 74. Loc. Martigny, in August. The second generation of *celadussa* Fruhst. with paler ground-colour and reduced black markings. A " dry " form.

submaxima *Melitaea athalia* race *submaxima* Verity, 1924. *Ent. Rec.* **36** (Suppl.) : 40. Loc. Coastal region of Tuscany and Liguria. Forte di Marmi. A large form with a strong bright pattern that appears in some damp localities. Fig. Verity 1940, Nos. 40–42.

subtus-nigrescens *Melitaea athalia* ab. *subtus-nigrescens* Caruel, 1944. See p. 103.

suessula *Melitaea athalia suessula* Fruhstorfer, 1916 (1917); *Arch. Naturgesch.* **82** (A) (2) : 4. Loc. Bavaria, Moors. A small dark form with neat markings. The male holotype is in Coll. Fruhstorfer in Mus. nat. Hist. nat., Paris, and it is figured by Verity 1940, No 327 and paratype No. 238.

synexergica *Melitaea athalia* race *synexergica* Verity, 1930, *Ent. Rec.* **42** : 133. Loc. Canton Soleure. A name for specimens from this district which show many examples with the male genitalia intermediate between *athalia* and *celadussa*.

tectensis *Melitaea athalia* ab. *tectensis* Cabeau, 1922. See p. 103.

tenuicula *Melitaea athalia* race *tenuicula* Verity, 1919, *Ent. Rec.* **31** : 193. Loc. Bolognola, Monte Sibillini, Italy. A mountain race smaller than *tenuis*. It is doubtful whether this can be considered an adequate description. If not, the name should date from Verity's description and figure, 1940, Nos. 37–39. This is a remarkable small and pale form. The whereabouts of the holotype is not stated by Verity. A paratype is to be found in Coll. Brit. Mus. (Nat. Hist.).

tenuis *Melitaea athalia* race *tenuis* Verity, 1919, *Ent. Rec.* **31** : 193. Loc. Florence. A rather small and light-coloured form. Verity says that it occurs all over Peninsular Italy, Sicily and Spain. In fact Spanish examples from moderate altitudes are usually larger than Italian specimens, and cannot be united with them in my opinion. Verity does not mention a specification of holotype. A reputed paratype is to be found in Coll. Brit. Mus. (Nat. Hist.).

teriolensis *Melitaea athalia* var. *teriolensis* Wagner, 1912. See p. 103.

tesselata *Melitaea tesselata* Stephens, 1827, *Ill. Brit. Ent. Haust.* **1** : 31. A name for a crude figure in Petiver that shows what is probably a normal specimen of British *athalia*. This is the first use of the name in a correct binomial application. Valid and available for a local form if required.

tinica *Melitaea athalia tinica* Fruhstorfer, 1910., *Soc. ent.* **25** : 51. Loc. Irkutsk. A large dark form of *athalia*. The holotype is in Coll. Fruhstorfer in Mus. nat. Hist. nat., Paris, and is figured by Verity 1940, No. 210 and paratypes 211, 212.

tricolor *Melitaea athalia* ab. *tricolor* Hormuzaki, 1897. See p. 103.

uncummimans *Melitaea athalia helvetica* ab. *uncummimans* Verity, 1940. See p. 103.

unifasciata *Melitaea athalia* ab. *unifasciata* Caruel, 1944. See p. 103.

veragrorum *Melitaea athalia* race *veragrorum* Verity, 1935, *Ent. Rec.* **47** (Suppl.) : 74. Loc. Bex near Geneva. Rather darker than *celadussa* and almost exactly like *divergens*, but the females are darker. Fig. Verity 1940, Nos. 59–61.

virgata *Melitaea athalia* ab. *virgata* Tutt, 1896. See p. 103.

vividior *Melitaea athalia* var. *vividior* Gouin, 1922, *Act. Soc. linn. Bordeaux* **74** : 28. Loc. St. Côme, Gironde. A large and rather dark form with genitalia of *athalia*.

Melitaea mayi Gunder, 1929, *Bull. Brooklyn ent. Soc.* **24** : 327. Pl. 31, fig. 6. Loc. Ptarmigan Valley, near Banff, Alberta, Canada. 28.viii. Examination of Gunder's figure suggests that this insect may be placed as *athalia ambigua* Ménétriés in a form near *niphona* Butler. This attribution has been confirmed recently by N. W. Gillham who has dissected one of the paratypes and has published a figure of the male genitalia (1954, *Psyche, Camb., Mass.* **16** : 61). The holotype with 9 other specimens is in the American Museum of Natural History. These are all labelled Banff, Alberta, 16–20 July, 1929, collected by J. F. May, except one labelled 8–10 July, 1931, from A. N. Gartrell, but possibly all came from May and through the Gunder Collection.

One other specimen from the Sternitzky Collection, perhaps also from May, is now in the possession of C. F. dos Passos, who has kindly sent me these particulars. I am told that there is a possibility that the locality data are not reliable. The large form shown should be flying at a moderate or low elevation and in a moderately warm district, and it is quite unlikely to be met in a high alpine valley. No other Nearctic species of *Mellicta* is known and in my view some confirmation of the facts reported must be awaited before *athalia ambigua* can be accepted as an American butterfly.

MELLICTA DEIONE (Geyer) **comb. nov.**

In size and general appearance this insect is very similar to *M. athalia*, although separation is not difficult once the differences are recognised. On the upper surface in *deione* the standard black markings are complete and noticeably regular. On the fore wing the black discal macules are only slightly emphasised and form a uniform series, and posterior to this the orange fascia is not particularly wide. A prominent black mark in cellule 1b shaped like an X is rarely seen in *athalia*. On the hind wing several black macules form a series across the disc, and an oblique marking in cellules 4, 5 and 6 is usually conspicuous. The black marginal line is relatively wide, especially on the hind wings, and fused with the internervural dots, which are sufficiently developed to make the marginal lunules deeply excavated. In most examples there is a pale streak along the body groove, best developed in cellule 1b. On the under surface the colouring of the hind wings is characteristic. The usual orange fasciae are both present, but all other macules are pale yellow and the brown and grey scales, so often seen in *athalia*, are rarely obvious. The pale discal field is evenly divided by a series of black lines. Viewed from above the palpi are orange or orange-brown.

The females commonly show slight colour contrast on the upper-surface, and in some cases this may be quite marked (♀–form *phoibophila* Bryk), with the submarginal fascia of both wings rather orange against the paler yellow ground-colour. Geyer's figures 948 and 950 are particularly good and show well the uniform ground-colour relieved by the bright orange fasciae.

Genitalia. In the male, viewed from above (fig. 31), there is a wide tegumen with a well-developed shoulder at the junction with the vinculum on each side. This feature is rarely well developed in *athalia*. In lateral view (fig. 32) the clasp resembles *celadussa* Fruhst. The posterior process is variable, usually slender, with 2 or more small teeth along the superior margin and a larger tooth near the apex. It may be wider, with more numerous teeth (fig. 32*c*). The aedeagus (fig. 33) is characteristic. In lateral view there is a well-developed morula and ostium-fold, while the ostium-keel is rather short and the tip is strongly turned up like a snout, in a manner that is never found in *athalia*. This peculiarity was recorded by Dampf (cf. Ribbe 1910, *Iris*, Beiheft : 142), but is seldom referred to. The male foreleg (fig. 35) is better developed than in other members of the genus and forms a striking contrast with the degenerate limb shown by *athalia* (fig. 1). The female genitalia (fig. 34) show small but constant difference from *athalia*. The whole structure appears more compressed from before

backwards and the auricles are most distinct. The anterior border of the ninth body segment is slightly but definitely pigmented and covered with small pits, a feature that is scarcely obvious in *athalia*.

Early stages and habits. As far as I can discover the only serious description of the larva is that given by Rühl, although there are frequent notes that the butterfly has been bred by many. According to Rühl the full-grown larva has a black head and the body segments are coffee-brown, with four rows of small yellowish-white macules. The spines are yellowish-white with black bristles (Rühl, 1895 : 403 ; Spuler **4** : Pl. 24, Suppl. 1, fig. 10). The pupa is well-described by Wheeler (1911, *Entomologist* **44** : 12), who states that it varies a good deal from dark grey to black, with the usual orange and white tubercles and mottling. This description was made from specimens of *berisalii* Rühl. All authors agree that the food-plant is *Linaria*, including the species *monspeliensis* and *vulgaris*, and probably also *Antirrhinum sempervirens*. It is said that the flowers are especially favoured.

Habitat. The perfect insect appears from early May until the end of June, according to the locality. It is commonest in hilly country, but at low or moderate elevations up to around 3000 ft., more rarely to 5000 ft. It loves to float about in stony places, rocky paths, etc. In nearly all districts, at least at lower levels, a second brood appears at the end of July. The specimens are much smaller than those of the early brood, and less common in collections, possibly because the late emergence is only partly complete. In general, the wing-markings are remarkably stable, and it is rare to find those strange individual aberrations of pattern that are common in other species of the group. Local variation follows the usual cline with pale ground-colour and thin black markings in hot localities and slightly darker specimens with heavier black pattern in colder districts. These modifications are less striking than is the case, for example, in *athalia*. This may be due to the restricted range of *deione* in the warm and dry districts of south-western Europe (Map 1), and restriction also to a certain biotope. At the same time the insect is clearly sensitive to climatic changes and Agenjo has recorded that in central Spain the high level modification *signata* de Sagarra is well developed in wet seasons, while in dry years more typical examples are met with in the same localities (1933, *Eos, Madr.* **9** : 106). It is one of the most characteristic butterflies of Spain and Portugal, and appears in hot and dry localities in southern France as far northwards as Lozère. In Switzerland it is restricted to a few localities in the Valais and Tessin, and other colonies are known here and there along the southern slopes of the Alps as far east as Merano. It has not been found in any Italian mountains south of the Alps. A few colonies have been recorded in the mountains of Morocco and Algeria.

Although in some respects variation is not striking, there has been greater progress towards differentiation of subspecies than is the case in most related forms. No doubt the strict isolation of colonies and dependance upon certain food-plants is principally responsible for this. It is suggested also that *deione* represents a pre-Glacial fauna of great antiquity.

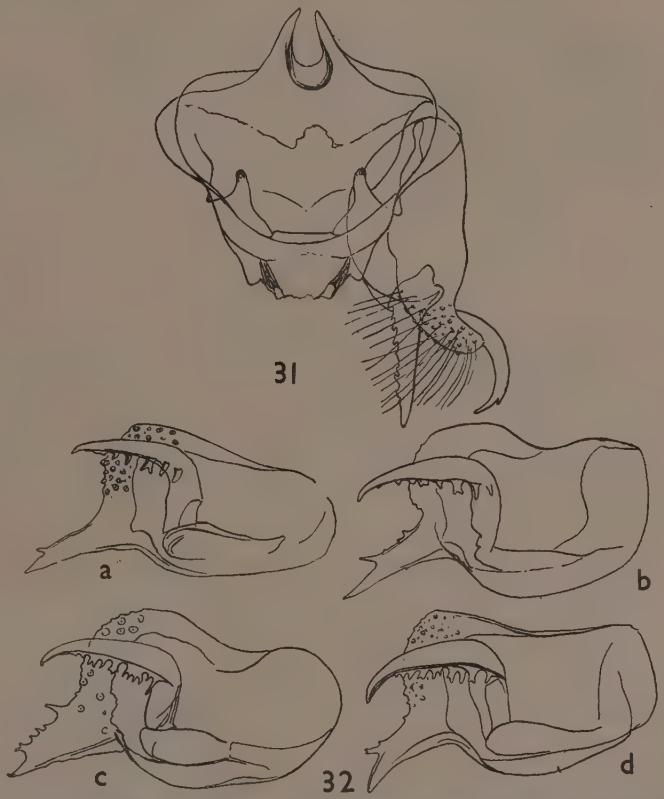
Subspecies.

Three sub-species are recognised.

1. *Mellicta deione deione* (Geyer) **comb. nov.**

Papilio deione Geyer, 1832, *Sammlung Europ. Schmett.*, fig. 947–950. Loc. "Swiss Alps" *fide* A. F. Hemming. Figs. Verity 1940, No. 16/17; 19/20; 204/206; 265/266; 270.

The holotype is not preserved and possibly none was specified. The excellent figures are easily identified as this species. The locality "Swiss Alps" is certainly an error. According to Duponchel (1832, *Hist. Nat. Lép. France*, Suppl. (1) : 276) the first specimens were taken near Aix in 1826 by the Comte de Saporta, who pointed out the distinctive specific characters.



Figs. 31–32.—*Mellicta deione* (Geyer). (31) Male genitalia, dorsal view. Cintra. (32) Clasp, lateral view. *a*, Digne, Provence; *b*, *M. d. berisalii* Rühl, La Batiaz; *c*, *M. d. deione*, Oulz Meana; *d*, *M. d. nitida* Sebdou, Algeria.

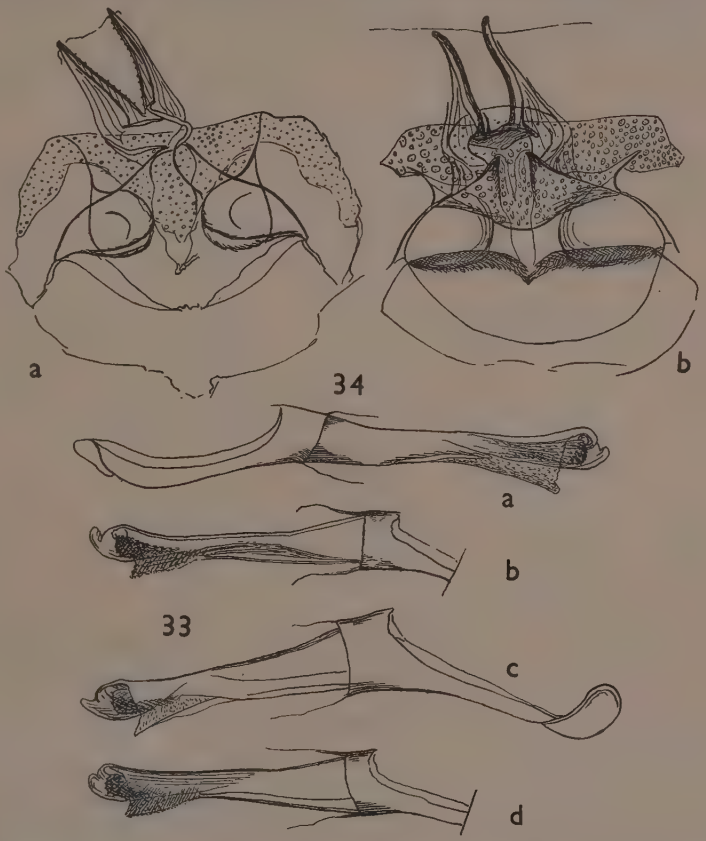
Exp., ♂ 30–40 mm.; ♀ 34–44 mm. Fore wing ♂ 17–20 mm., ♀ 18–21 mm. (Gen. l.) The general specific features have been described. The subspecific characters include a clear yellowish-orange ground-colour and, in the "dry" modifications, fine and regular black markings. Often the terminal black line can be recognised as double. In the female colour contrast is often marked. The second generation is smaller, with a wing expanse in the male of 28–32 mm. and in the female up to 35 mm.

Variation. Examples showing abnormal pattern mosaics are rare, but forms of *aphaea* Hb. and of *pyronia* Hb. are recorded (Oberthür, *Ét. Lép. comp.*, fig. 5). Environmental variation follows the usual pattern, but it is very slight compared with *athalia*. In the typical form of Provence, so well illustrated by Geyer, the ground-colour is pale and the markings delicate. Specimens from most localities in southern France and central Spain appear to be typical. Slight modification is found in specimens of the first generation from Andalusia and Murcia, which are particularly large and brilliant (*magna* Seitz). Bright and luxuriant forms, which almost rival the splendour of the Andalusian specimens, appear also in the eastern Pyrenees at Vernet-les-Bains, Porta, Porte, etc., in colonies which may reach an elevation of 5000 ft. If a name is required for these specimens *praestantior* Verity appears to be most suitable (but see also *mirabilis* Rutimeyer). At considerable elevations in the mountains of Aragon and in the Asturias the insect flies in a smaller and darker form, which represents the opposite extreme of the typical cline. This modification has been named *signata* de Sagarra from a series taken on the Montseny near Barcelona. This is probably the most suitable name for the high-level Spanish modifications, e.g. from the Picos de Europa district and the Puerta de Pajares. These specimens show a tendency to lose the characteristic *deione* features on the disc of the hind wing and on both surfaces the approach to *athalia* may be very close. A corresponding form with heavy black pattern occurs at Gedre and elsewhere (*rondoui* Ob.). This differs slightly from *signata* de Sagarra in that the *deione* features of the wing-pattern are far better developed and the black marginal border of the hind wing is often exaggerated. Examples from the Eastern Pyrenees (Vernet les Bains, etc.), already referred to above, are entirely different and do not show the features of a mountain form. Specimens from southern Portugal (Cintra) show a curiously dark ground-colour on the upper surface, with strongly marked black pattern. These were named *rosinae* by Rebel from specimens bred by Rothschild, and the typical series is now preserved in the British Museum Collection (Tring). Fruhstorfer evidently noticed this form, which he described again as *philomena*, and it may prove to be an interesting and constant modification. Specimens of the second generation from the Sierra de Estrela (Verity 1940, Nos. 28, 29) look identical with ordinary Spanish specimens.

Other forms difficult to place may be mentioned here. Fruhstorfer has described as *tessinorum*, a form taken at Biasca on the Ticino. This is said to be transitional to *berisalii* Rühl, but no specimens are available for comparison. Another from Meana near Oulz in the Susa Valley of Piedmont also shows an approach to *berisalii*, but again I have only a single specimen for comparison. The species appears in a few localities near Brixen, about 50 miles east of Biasca, the nearest known locality in Switzerland. Of this form named *phaisana* by Fruhstorfer I have for comparison only three examples and the figures given by Verity 1940, Nos. 19, 204, 205, and 1950, Pl. 44, Nos. 44–48. Examination of this inadequate material suggests a close resemblance to high level forms from the Central Pyrenees (see also *felkeli* Stauder and *rafaëla* Fruhstorfer). It seems probable that all these forms may be placed as modifications of nomino-typical *deione* and of these only *phaisana* may be sufficiently distinct to require a name.

Localities.—France : Occurs commonly in hot dry localities in the south.

Especially frequent in Provence and Auvergne. Recorded also from Bouches-du-Rhone ; Var ; Hte. Garonne ; Lozère, etc., Digne ; Beauvezer ; Draguignan ; Tenda (doubtfully crosses to the east of the Alps) ; Basses Pyrénées ; Hautes Pyrénées ; Pyrénées Orientales. SPAIN & PORTUGAL: Common and generally distributed ; occurs in the mountains up to an altitude of 5000 ft. There is an abundant first generation in the Sierra Penibetique, but I have not



FIGS. 33–34.—*Mellicta deione* (Geyer). (33) Adeagus, lateral view. *a*, La Batiaz ; *b*, Vernet les Bains, Pyrenees Or. ; *c*, Cintra, Portugal ; *d*, Espinama, Asturias Mts. (34) Female genitalia, dorsal view. *a*, Cuenca, Arragon ; *b*, La Batiaz, Switzerland.

seen any examples of the second generation from these mountains. ITALY : At present known only from Meana in the Susa Valley, where I discovered a colony in 1929, and from the neighbourhood of Merano in the valley of the Adige (Eisaktal) ; Mendelstrasse (*fide* Dannehl). SWITZERLAND : Specimens recorded by Fruhstorfer from Biasca may be referable to the typical subspecies. Other records refer to the form *berisalii* considered a distinct subspecies and dealt with below.

2. *M. deione berisalii* (Rühl) **comb. nov.**

Melitaea berisalii Rühl, 1891, *Soc. Ent.* 5 : 149. Loc. "Simplon", Valais. Figs., Oberthür, *Ét. Lép. comp.* 1 : fig. 5, 6. ; Verity 1940, No. 20.

The whereabouts of the type is not known : possibly no type was specified. It is not present in the Rühl collection now at Florence.

Exp., ♂ 35 mm.–37 mm. ; ♀ 37 mm.–40 mm. (Gen. 1.)

In the male the outer margin of the fore wing is often very straight, so that the wing appears more pointed than usual. On the upper surface the ground-colour is darker and more tawny in tone, i.e. less orange-yellow. The submarginal macules of the hind wings

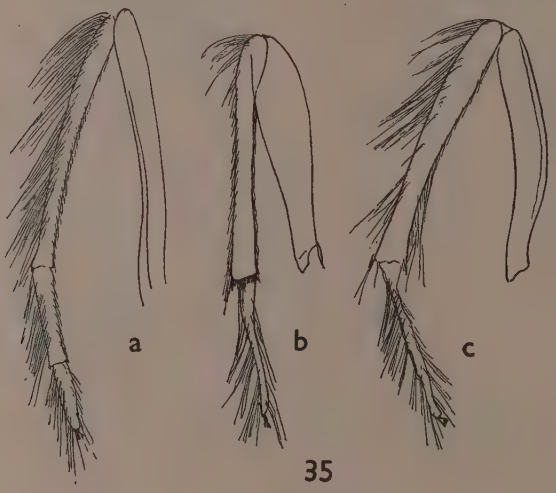


FIG. 35.—*Mellicta deione* (Geyer). Male fore-leg. *a*, Sebdou, Algeria ; *b*, La Batiaz ; *c*, La Batiaz.

are frequently of a darker tone than the macules of the discal band and show some contrast even in the male. The black pattern is strong and regular, the X-shaped mark on the inner margin of the fore wing is almost always well formed and the coastal bar of black discal macules is straight and even. The black marginal border is wide, especially on the hind wings, where the marginal lunules are almost obliterated anteriorly. On the under surface the tawny fasciae of the hind wings stand out in brilliant contrast with the pale yellow, almost white, ground-colour. The components of the terminal (marginal) line are swollen into narrow crescents which are quite conspicuous. The female is larger but in markings and colour resembles the male. I have never seen forms showing colour contrast such as are met with in so many localities. The second generation flies in August, and appears to be relatively common. The specimens are small, with an expanse of 30 mm. or less in the male.

From examination of good series available it appears that *berisalii* is relatively well-defined as a subspecies, easily recognisable and uniform in series. I do not feel that it is possible to include this form within the cline of normal variation shown by typical *deione*. Some details of the life-history are given

by Favre (1899, *Fn. Lep. Valais* : 33), who states that the eggs are laid upon *Linaria vulgaris* or *L. minor* and that the larva lives exclusively upon these plants, at first together in a web and later dispersing to live singly. The pupa is fixed to ricks, walls, etc., and emergence occurs in 15 days. The butterfly was described as a new species and attributed first to *deione* by Oberthür (*loc. cit.*).

Locality. This form is known only from a few localities in WESTERN SWITZERLAND : in the Rhone Valley of the Valais :—Martigny (La Batiaz, Plan Cerisier) ; Saillon ; Varen.

3. *M. deione nitida* Oberthür.

Melitaea deione nitida Oberthür, 1909, *Ét. Lép. comp.* **3** : 254 & **10** : 105, figs. 2305/2306. Loc. Sebdou, Algeria.

Fore wing, ♂ 19–20 mm. ; ♀ 21 mm.

The lectotype from the original series now specified in the Coll. Brit. Mus. (Nat. Hist.) No. 15991.

In most specimens the outer-margin of the fore wings is strongly convex and in consequence the wing appears wide and rounded. On the upper surface the ground-colour is pale orange with fine black markings. The orange marginal lunules are relatively very large and the black terminal line is narrow and clearly double. On the hind wing the usual black macules that cross the discal area are absent in most specimens, leaving a wide and clear field. On the under surface the pale discal band of the hind wings is often unmarked and the usual series of black linear macules is almost or quite absent.

Although the characters just described merely suggest an extreme dry modification, this seems to me a well-marked form which differs in a subtle manner from typical *deione*, so that some examples are scarcely recognisable as that species. I cannot agree with Oberthür that *nitida* should be united with specimens from Andalusia. The genitalia agree with those of the typical form.

Localities.—ALGERIA : Tlemcen ; Sebdou (May). MOROCCO : El Rif, Izalan, 8.vi. (*Reisser*).

The following forms of *Mellicta deione* have been described and named :—

berisalensis *Melitaea berisalensis* Rühl & Favre, 1897, *Mitt. schweiz. ent. Ges.* **10** : 34. Nom. nov. pro *berisalii* Rühl, which is stigmatised *nomen barbarum*. The original name of *berisalii* is perfectly valid according to modern rules of nomenclature and *berisalensis* must be placed as a synonym.

berisallela *Melitaea dejone* exerge *berisalii* Rühl gen. 2 *berisalella* Verity, 1935, *Ent. Rec.* **47** Suppl. : 76. Name for second generation of *berisalii* Rühl.

berisali *Melitaea athalia* v. *berisali* Staudinger, 1901, *Cat.* (Ed. 3) : 30. Clearly a *lapsus calami* for *berisalii* Rühl.

berisalii *Melitaea berisalii* Rühl, 1891, *Soc. ent.* **5** : 149. Loc. "Simplon". *Melitaea athalia* var. *berisalii* Rühl, 1893, *Pal. Grossschmett.* **1** : 406. Now attributed to *athalia*. First attributed to *deione* by Oberthür, 1904, *Ét. Lép. comp.* **1** : 14.

dejone A variant of the name *deione* Geyer, which is employed by Verity in many papers. There is no justification for this practice.

dejonella *Melitaea dejone* gen. 2 *dejonella* Verity, 1930, *Ent. Rec.* **42** : 134. Loc. St. Zacharie (Var). A name for the small second generation of Provence. Exp. ♂ 30 mm.–32 mm. ; ♀ 34 mm.–36 mm.

espunaensis *Melitaea deione* var. *espunaensis* Korb, 1915, *Mitth. münch. ent. Ges.* **6** : 36. Loc. Sierra d'Espuna (Murcia). 6 paratypes have been examined through the courtesy of Dr. W. Forster. I found little to distinguish this form from specimens from the Sierra Nevada (*magna* Seitz). Some females showed particularly good colour-contrast. The holotype is in the Zoological Museum at Munich.

felkeli *Melitaea deione felkeli* Stauder, 1922, *Ent. Anz.* **2** : 133. Loc. Brixen, South Tirol. A rather pale form taken in June at subalpine level. The whereabouts of the holotype is not stated and no specimens have been seen. Probably a synonym of *phaisana* Fruhst.

iberanana *Melitaea athalia* gen. 2 *iberanana* Verity, 1930, *Ent. Rec.* **42** : 135. Loc. Portugal. The name was proposed for the " small second " generation of *athalia hispanica*, but described from Portuguese specimens. An accurate identification of this form was made possible by the figures given by Verity 1940, Nos. 28, 29, which we may suppose were part of his original series, although there is no mention of a holotype. These figures show small *deione* Geyer of the second generation.

interligata *Melitaea deione* ab. *interligata* Pionneau, 1932. See p. 99.

magna *Melitaea athalia magna* Seitz, 1909, *Grossschmett. Erde* **1** : 222. Loc. Southern Spain. Ribbe (*Iris* **23** Beiheft : 136) says the typical specimens were really *deione* caught by his father in Andalusia. This was confirmed *in litt.* by O. Bang-Haas. The holotype of *magna* cannot be found with other material used by Seitz in the Zoological Museum at Berlin. Since *athalia* is so rare in southern Spain I feel that Ribbe's statement that *magna* is a form of *deione* can be accepted without question.

melanalbinotica *Melitaea deione melanalbinotica* Wehrli, 1920. See p. 100.

mirabilis *Melitaea deione* var. *mirabilis* Rutimeyer, 1942. *Mitt. schweiz. ent. Ges.* **18** : 441. Loc. Porte, Pyrén. Or. This is a large and brilliant form approaching the Andalusian *magna*. It appears around Vernet-les-Bains and in many localities in the Eastern Pyrenees. At Porta I have taken it flying as 5000 ft. Rutimeyer records his locality as 1750 m. It is probably synonymous with *praestantior* Verity, 1932.

nitida *Melitaea deione nitida* Oberthür, 1909, *Ét. Lép. comp.* **3** : 254. Loc. Sebdou, Algeria. See p. 57.

phaisana *Melitaea deione phaisana* Fruhstorfer, 1916 (1917), *Arch. Naturgesch.* **82** (A) (2) : 1. Loc. South Tirol (Klausen *secut* Verity). Said to be intermediate between *deione* and *berisalii*. The distinctive features are not well explained. I have not seen sufficient material of this form to place it with confidence. The holotype is in the Mus. nat. Hist. nat., Paris. See p. 54.

phaisanella *Melitaea dejone phaisana* Fruhst. gen. 2. *phaisanella* Verity, 1950, **4** : 163.

philomena *Melitaea deione philomena* Fruhstorfer, 1917, *Arch. Naturgesch.* **83** (A) (6) : 12. Loc. Portugal. Fruhstorfer described a form with dark ground-colour and heavily marked with black. Described from 4 ♂♂ and 4 ♀♀ in Coll. Turati at Zürich. Probably a synonym of *rosinae* Rebel.

phoibophila *Melitaea deione magna phoibophila* Bryk, 1940, *Ark. Zool.* **32** (A) (22) : 18. Loc. Sierra Nevada. A female form with contrasting colours. See p. 51.

praestantior *Melitaea deione* race *praestantior* Verity, 1932, *Ent. Rec.* **44** : 141. Loc. Southern France : Var ; St. Baume. A name for the exceptionally large and brilliant specimens that appear among the typical form in some localities. Fig., Verity, 1940, No. 16. See p. 54.

rafaëla *Melitaea deione rafaëla* Fruhstorfer, 1917, *Arch. Naturgesch.* **83** (A) (6) : 11. Loc. Northern Italy. On the upper surface the black pattern is said to be more regular than in typical examples from Provence. On the under surface the ground-colour is nearly pure white. I have not seen specimens to correspond with this description. It is unfortunate that the locality is not more accurately recorded. The male holotype and female allotype are both in the Mus. nat. Hist. nat., Paris. Paratypes are figured by Verity 1940, Nos. 204, 205.

rondoui *Melitaea deione rondoui* Oberthür, 1909, *Ét. Lép. comp.* **3** : 254. Loc. Gèdre, Htes Pyrénées. Figs. 2307, 2308. The submarginal orange macules are noticeably wide and in many specimens the black markings are exaggerated, especially along the wing-margins. This feature is not well shown in the figures. The species flies up to around 4500 ft. and no doubt examples from the higher altitudes will be darkest. The male lectotype now designated is in Brit. Mus. (Nat. Hist.) No. 15993, and figured by Oberthür as above.

rosinae *Melitaea deione rosinae* Rebel, 1910/1911, *Ann. naturh.* (*Mus.*) *Hofmus. Wien* **24** : 375. Loc. Cintra, Portugal (text fig.). A form with the ground-colour of dark tone and heavy black markings. I have examined two males from the typical series in the Brit. Mus. (Nat. Hist.) at Tring and confirm that they belong to *deione*. (See *philomena* Fruhst.) The specimens are quite unlike the usual form from southern Spain. The male lectotype is in Brit. Mus. (Nat. Hist.) No. 15995.

royoi *Melitaea deione* ab. *royoi* Agenjo, 1933 (1934). See p. 102.

signata *Melitaea deione* race *signata* de Sagarra, 1926, *Butll. Inst. catal. Hist. nat.* (2) **6** (6/7) : 132. Loc. Seva, Montseny, vii–viii. With darker ground-colour and more extensive black pattern than appears in the typical form. The name is suitable for the small and dark modifications that appear in many high mountains. Holotype male in Nat. Hist. Mus., Barcelona.

tessinorum *Melitaea deione tessinorum* Fruhstorfer, 1918, *Soc. ent.* **33** : 22. Loc. Biasca, Tessin, end of July (possibly second generation). With pale ground-colour but heavy black pattern and said to form a transition towards *berisalii*. I have not seen specimens of this form. The holotype is not now at the Mus. nat. Hist. nat. Paris.,

vesubiana *Melitaea dejone* race *vesubiana* Verity, 1932, *Ent. Rec.* **44** : 141. Loc. St. Martin Vesubie. A large race with rather heavy black markings and variegated females. Fig. female holotype Verity 1940, No. 206.

vesubiella *Melitaea deione* race *vesubiana* gen 2 *vesubiella* Verity, 1932, *Ent. Rec.* **44** : 141. A name for the second generation of *vesubiana* Verity. The males are said to be generally under 40 mm. in wing expanse. Taken 10.viii.

MELLICTA BRITOMARTIS (Assmann) **comb. nov.**

There is so much confusion in the literature regarding this species that I feel a short account of the introduction of the name and of its later application should be given here. In his original paper Assmann gave a full description of the external characters of a new species of *Melitaea* taken by him in a restricted locality near Breslau. This was amplified three years later (1850) with details of the larval and pupal characters compared with those of *athalia* Rott., *aurelia* Nick., *asteria* Freyer, and *dictynna* Esp. (*diamina* Lang). It is clear that Assmann thought he had complete evidence of the existance of an undescribed and previously unrecognised species. Prittwitz (1861) repeated Assmann's observations and made further comments. From his writing it appears that he was

quite familiar with all the species brought into comparison. For many years after this the name remained a favourite topic for discussion but without really precise significance, until in 1912 Suschkin published his excellent paper with careful figures of the genitalia of all the commoner species of *Melitaea*. Among them was a figure, taken from a specimen from Kharkoff, of a form that he attributed to *britomartis* Assmann. This paper showed for the first time a method of making precise specific identification of Melitaeid butterflies, and in addition the figure of *britomartis* served to define and to restrict the name to a definite specific unit. It was not known for some years that specimens with identical genitalia occurred in central Europe. These were discovered first in 1922 by Reverdin in a specimen taken near Turin and figured under the name of *athalia* Rott. Eight years later this specimen was referred by Verity to an insect he had named *aureliaeformis* in 1917. Again in 1930 Rocci described the butterfly as *melathalia* from specimens taken at Galliate near Milan. Perhaps, also, this was the species from Roumania named *pygmaea* by Hormuzaki in 1923. During the last twenty years it has been recognised that the new species, in size between *aurelia* and *athalia*, does occur over a wide area of eastern Europe, as far north as Sweden, and the typical male genitalia, first illustrated by Suschkin, are well known. In 1940, for the first time, the various forms described are associated in a single specific unit by Verity, including a somewhat uncertain form from Siberia (*amurensis* Stgr.), described as long ago as 1892 as a variety of *aurelia*, and which clearly belonged to this group. Unfortunately Verity went rather too far and included at least three distinct species in what he termed the "*britomartis*" group, but with better knowledge of the genitalia it is not difficult to separate the component forms, only one of which occurs in Europe. That the specific definition is now well understood is clear from recent papers by Petersen (1945) and de Lesse (1951).

What evidence is there that the name *britomartis* should be attributed to this newly recognised species? Externally the insect can be identified in many cases but not in all, and never perhaps with complete confidence without examination of the male genitalia. At the same time many examples are sufficiently unlike both *aurelia* and *athalia* to call for critical examination. Assmann refers in his description to several features that rarely appear in *athalia* or in *aurelia*. He refers to the size of the butterfly, between that of the two common species, and to the late date of emergence, to the wide fore wings, and on the under surface of the hind wings to the intense "cinnamon-brown" markings, the mother-of-pearl lustre of some of the pale macules, the frequent traces of "*dictynna*" spots in the macules of the submarginal fascia and to the pigmented orange terminal line that is often present along the outer margin. All these features are strongly suggestive of the newly separated species and the description is supplemented by an account of the larva and pupa, which are stated to differ substantially from those of the related species. The specific features of these butterflies are more obvious in the early stages than in the perfect insects, and the specific identification of Assmann's insect must rest largely upon his account of the larva. In my opinion the final confirmation of the identity of the species to which the name *britomartis* should refer and of the accuracy of Assmann's observations has come with the publication of Urbahn's paper already referred to, and now there is no reasonable doubt of the correct use of this name that has been a problem for longer than a century.

A note on *Melitaea veronicae* Dorfmeister, 1853, *Verh. zool.-bot. Ges. Wien* **3** (Sitzungsb.) : 136–138. Loc. Bruck a. d. Mur.

Ever since publication this name has provided a riddle that has only lately been solved. The full title of the article by Dorfmeister is as follows : " Beobachtungen über die Raupen u. Puppen der mit *athalia* nächstverwandten Meliteen." The author states that at the end of May and early in June he bred *athalia*, *aurelia* and *another* species near *dictynna* Esp., but that the last insect does not fly in the neighbourhood. The imago of the new form is not described further. He goes on to say that the larva of *aurelia* lives only on *Plantago*. It is dark grey strewn with pearl-white atoms, which leave a dark dorsal line uncovered. The spines are darker, not dilated at the base, reddish with white tips and stand in flesh-coloured warts.

The larva of the new butterfly occurred on *Veronica chamaedryas*, *Melampyrum* and *Chrysanthemum*. Only one fully developed example was bred with four cripples. The larva was violet-grey with white atoms and a dark dorsal line. The horns were white, standing in yellow warts.

This description agrees so well with Urbahn's figure of the larva of *britomartis* that there can be little doubt that *veronicae* was also applied to the same insect. It should stand as a synonym of *britomartis*, and the name is valid and available if required. This application of the name *veronicae* is also considered correct by Förster (1953, *Schmett. Europ.* : 63). On the other hand, Urbahn himself is not yet prepared to consider the specific identity of *veronicae* as finally settled (Urbahn, 1952 : 119).

Knowledge of the distribution and local variation of this species is quite inadequate to allow any worth-while grouping of racial or geographical forms. A general survey of available specimens from Italy, Bulgaria and from central and eastern Europe suggests great individual variability in all localities. Many specimens can be identified by external characters, especially by the strongly marked pattern and intense coloration on the under surface of the hind wings. In other cases the resemblance to *aurelia* and more rarely to *athalia* is so close that no certain distinction is possible. I have treated the species below under four groups or subspecific headings, which is at best a provisional arrangement, but will serve to point out the main features of geographical distribution.

1. *Mellicta britomartis britomartis* (Assmann) **comb. nov.**

Melitaea britomartis Assmann, 1847, *Ent. Z. Breslau Lep.* (1) **1** : 2. Loc. Breslau.
Melitaea veronicae Dorfmeister, 1853, *Verh. zool.-bot. Ges. Wien* **3** (Sitzungsb.) : 136–138. Loc. Bruk a. d. Mur.

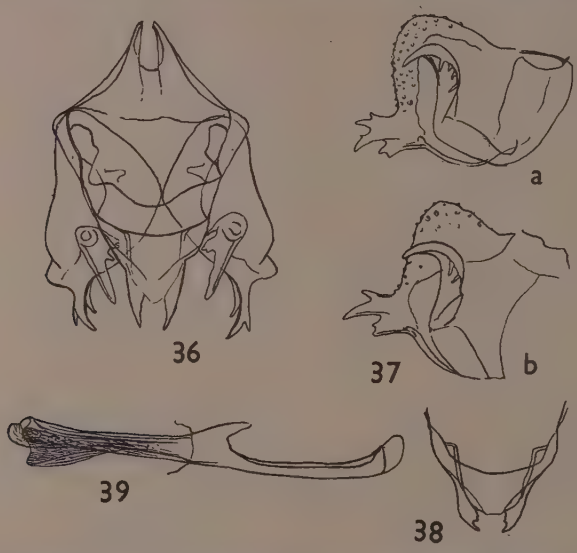
The whereabouts of the holotype is not known and probably none was specified. Determination must rest upon the special features indicated by Assmann, and lately confirmed by Urbahn.

Fore wing ♂ 15–16 mm. ; ♀ 16–17 mm.

Several features that help to distinguish this insect have been considered already. Of

these one of the most constant is the orange pigment in the double marginal lines of the hind wing below. On the same surface of the fore wing the row of post-discal macules is usually complete. The yellow marginal lunules are more equal in size and do not show the marked enlargement that is so striking at the wing-apex in many specimens of *aurelia*. On the hind wing also the median and submarginal coloured fasciae are often so wide that the pale discal macules appear as a narrow fascia. I have not seen examples of the second brood from Central Europe. Variation occurs in the extent of dark shading on the upper surface, but no special tendency to melanism appears in any of my specimens, excepting a short series in Brit. Mus. (Nat. Hist.) from central Russia.

In the male genitalia (fig. 36) the tegumen is well developed with rather short sub-uncal processes. In one specimen these are definitely serrated along the medial margin (fig. 38).



FIGS. 36–39.—*Mellicta britomartis* (Assmann). (36) Male genitalia, dorsal view. Sliven. (37) Clasp, lateral view. *a*, Sliven (2) left clasp ; *b*, ditto, right clasp. (38) Tegumen Sliven (3), Bulgaria. (39) Aëdeagus, lateral view. Sliven, Bulgaria.

The clasp (fig. 37) is conspicuously deep, almost quadrilateral, with the posterior process short and showing a central tooth curved slightly downwards, with one or two secondary teeth springing from the upper border ; below this is a small and usually bifid tooth. The harpe is evenly curved with two or three teeth. The aedeagus is slender and straight (fig. 39), the ostium keel small and largely hidden by the folds and morula. The structure is very different in all respects from *athalia*. The development of the sub-uncus is not quite constant. Probably the best characters are to be found in the narrow elongated tegumen and in the aedeagus, which is unlike that of any other form found in Europe. An excellent figure was given by Suschkin, *loc. cit.* : 323, fig. 25, 26.

The female genitalia are shown in fig. 43*a*.

The early stages are admirably described by Urbahn (1952). The egg (figured by Urbahn, Pl. 12, fig. 1*b*) is slightly more pointed than that of *athalia*. The larva resembles that of related forms, but the white atoms are larger and

more numerous, so that the general tone of the larva is grey or violet-grey, as recorded by Assmann (Urbahn, Pl. 13A, fig. 1). The pupa is dark with white and orange markings which show a characteristic arrangement and allow specific identification without difficulty (Urbahn, Pl. 14, fig. A).

This description of the imago is based upon a series of specimens from central Europe, Bulgaria and Russia. The known distribution is indicated on Map 2.

Localities.—GERMANY : Various specimens without exact data. " Saxony" ; Berlin ; " Silesia " ; Breslau (Assmann) : Bruck a. d. Mur (Dorfmeister) ; " Southern Germany " (Petersen) ; Förster (1953) gives Central Europe extending to central Germany. SWEDEN : Reported by Petersen from several localities near Stockholm : Munko Islam ; Bollnas ; Regnsjo ; Kisu Og ; Ophem Og. HUNGARY : One specimen without further data in Brit. Mus. (Nat. Hist.). POLAND : A short series labelled " Lemberg " in Brit. Mus. (Nat. Hist.). BULGARIA : A series from Sliven taken by Mr. Haig-Thomas and myself 25–29.vi.1935. These examples were of the first generation and many show intense coloration on the under surface. Examples of *aurelia* and of *athalia* were taken at the same time. RUSSIA : A specimen labelled " Ufa " in Brit. Mus. (Nat. Hist.) is very dark and evidently corresponds to the modification *marussia* Fruhst., 1919.

2. *Mellicta britomartis aureliaeformis* (Verity) **comb. nov.**

Melitaea athalia aureliaeformis Verity, 1916 (1917), *Boll. Soc. ent. ital.* **48** : 186 (footnote). Loc. Venaria, Turin.

Melitaea melathalia Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184. Loc. Meadows along the Ticino and other localities in northern Italy.

Melitaea melathalia taurinorum Rocci, 1932, *Mem. Soc. ent. ital.* **10** : 210. Loc. Turin. Also ibid. **11** : 32 and 141, fig. 11*b*.

Figs. Reverdin, 1922, *Bull. Soc. lép. Genève* **5** : Pl. 1, fig. 9 ; Pl. 2, fig. 6. Rocci, 1930, *loc. cit.* Many excellent figures. Verity, 1940, fig. 137–139 and 1950, fig. 60–79 and genitalia. (In this case Verity does not include a figure of the male holotype.)

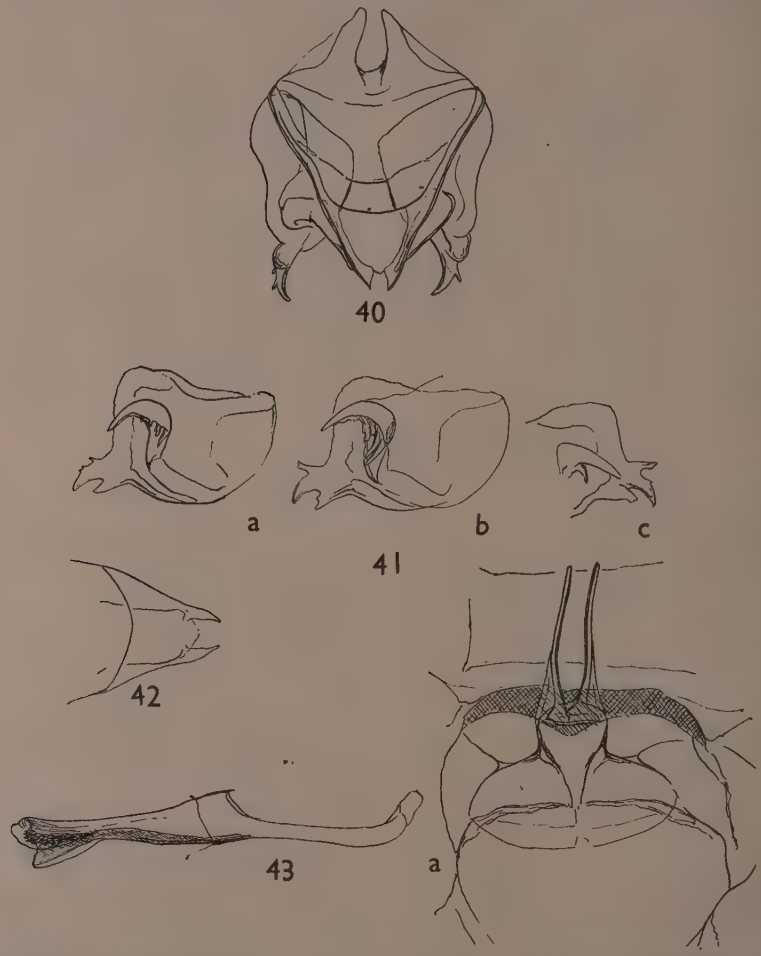
The name was introduced for the " small dark forms of *athalia* which fly in the district round Turin. These fly mixed with *athalia* and show all possible transitions so cannot be attributed to *aurelia*". This is the only description (in a footnote). In a later paper (1930) the name was referred to the insect figured by Reverdin in 1922, and in 1937 a figure was published of genitalia from the male holotype.

A discrepancy appears inasmuch as Reverdin's figure does not show a dark specimen, and in the monograph of 1940 *aureliaeformis* is said to be distinguished from other forms by the light tone of the orange marks and thin black lines of the pattern on the under surface of the hind wing. No doubt the holotype of *aureliaeformis* is in Dr. Verity's collection. The whereabouts of the holotype of *melathalia* is not stated.

Genitalia. The features of the male genitalia (figs. 40–43) correspond with those of the typical form. The deep and narrow tegumen is conspicuous. The female genitalia show a tall cone and small, compressed sterigma, quite different from the neat and symmetrical form of *aurelia*. The scutum is large.

My short series of 13 specimens from Turbigo near Milan is not in any way remarkable. In size they correspond with typical *britomartis* of the first genera-

tion. On the whole they show a greater tendency to melanism than appears in the northern specimens, but they come from a damp and low-lying locality which might easily explain this. I have no examples from Turin, but according to Rocci and to Verity (1940 : 661) these are less melanic, and do not show the



Figs. 40–43.—*Mellicta britomartis aurealiaeformis* (Verity). (40) Male genitalia dorsal view, Turbigo. (41) Clasp, lateral view. *a*, Turbigo 1 ; *b*, Turbigo 4 ; *c*, Turbigo 3. (42) Tegumen, Turbigo 3. (43) Aedeagus, Turbigo 1. (*a*) Female genitalia.

dark chocolate bands on the under surface of the hind wing nor the orange terminal line. In such specimens there will be a greater approach to some German examples. When I was collecting this insect in 1938 I was told that the Venaria locality had been lost and that search for the insect there had been

in vain. I was not more successful than other people and there can be no doubt that the butterfly at Venaria is extremely local and difficult to find, although I believe some have been taken again in quite recent years. In my view it is perhaps premature to accept Verity's statement that *aureliaeformis* has no summer brood. In its restricted locality near the river Ticino the insect is not rare and appears in two generations, both of which are illustrated by Rocci. The first brood emerges about the middle of May and is quickly over. A second brood of much smaller specimens flies at the end of July. I have no examples of this brood. The so-called " *dictynna*-spots " on the under surface of the hind wing are rarely well developed. Since the Italian localities now form an isolated distribution centre I have retained *aureliaeformis* as the subspecific name, although there is an obvious difficulty in reconciling Verity's later specification with his earlier short description. In any case it must be doubtful whether the paler forms of Turin are distinct from the usual central European *britomartis*. Rocci's name of *melathalia* is available for the dark forms that occur along the Ticino, which constitute a striking modification.

Localities.—Italy : Piedmont. Venaria Real, i.e. The Royal Game Forest. This is a large park near Turin. Reverdin's original specimen came from this locality, but the butterfly there is scarce and local. Rocci, under *melathalia*, gives Galliate and Turbigo with other localities along the river Ticino, and adds the following : Monte Musine ; Monferrato ; Val di Susa, Valle di Aosta ; Monti del Lago Maggiore ; Brianza ; Largo di Garda, Colline Modanese. It seems possible that there is some confusion between *aurelia* and *britomartis* and perhaps some of these localities refer to the former. Rocci's papers are extremely good, with excellent figures and well worth careful study. They provide the first indisputable evidence of the occurrence of *britomartis* in western Europe.

[*Additional references.*

Verity, R., 1930, *Boll. Soc. ent. ital.* **62** : 184.
——, 1938, *Mem. Soc. ent. ital.* **16** : 50, fasc. 1, Pl. 2.
Higgins, L. G., 1939, *Entomologist* **72** : 40.
Urbahn, E., 1952, *Z. wien. ent. Ges.* **37** : 105.]

3. ***Mellicta britomartis amurensis*** (Staudinger) **comb. nov.**

Melitaea aurelia var. *amurensis* Staudinger, 1892, *in* Romanoff, *Mém. Lép.* **6** : 186. Loc. Raddefskaja ; Sutschan ; Ussuri ; Baikal.

Melitaea aurelia seminigra Seitz, 1909, *Grossschmett. Erde* **1** : 221, Pl. 66, fig. h 6–7. Loc. Sajan Mts. nec *Melitaea dictynna* ab. *seminigra* Muschamp, 1905.

Melitaea aurelia form. nov. *seminigra* Nitsche, 1918, *Jber. wien. ent. Ver.* **28** (*Vereinsnachrichten*) : 9. Loc. Sajan Mts.

Melitaea britomartis frigidaltaica Verity, 1940, *Trans. R. ent. Soc. Lond.*, **89** : 656. Loc. Altai Mts.

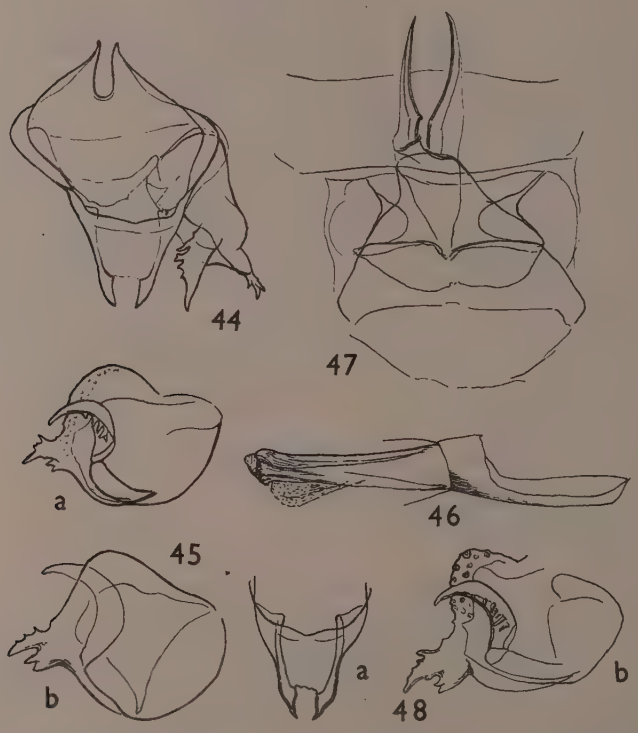
The lectotype of *amurensis* and six paratypes are in Coll. Staudinger, Berlin. The lectotype has been formally selected from the original series and dissected by the writer. The specimen and genitalia preparations have been returned to the Zoological Museum, Berlin. It is a male from Sutschan ; on the upper surface the standard black pattern is not heavily marked. In the Staudinger collection one specimen in each series is commonly marked by a rather large name label. It is held that this does not constitute selection of such a specimen as holotype or lectotype.

The holotype of *seminigra* Seitz (and paratypes) are in the Senckenberg Museum, Frankfurt a. Main.

The holotype of *frigidaltaica* is now in the Coll. Verity and was figured by Verity 1940, fig. 127 ; 312.

Fore-wing ♂ 15–18 mm. ; ♀ 18 mm. Exp. 25–35 mm.

Many specimens from the oriental range are rather small with the standard pattern fully developed and quite regular, without any distinctive features that I can detect. On the upper surface the costal bar of the fore wings may be straight or angled at the subcostal nervure. On the under surface of the fore wing the black discal macules form a



Figs. 44–48.—*Mellicta britomartis amurensis* (Staudinger). (44) Male genitalia, dorsal view. Troitzkossowsk, Amur. (45) Clasp, lateral view. *a*, Troitzkossowsk ; *b*, ditto, Sutschan, paratype from Coll. Staudinger. (46) Aedeagus, Troitzkossowsk, lateral view. (47) Female genitalia, dorsal view. (48) *a*, Tegumen ; *b*, clasp ; paratype of *seminigra* Seitz, from Senckenberg Museum.

complete series, sometimes joined together. The black post-discal fascia shows through from the upper surface or may appear as a series of black points. On the hind wings the pale macules are often shining white, more rarely yellow and the darker fasciae are brown or orange-brown. In particular the orange submarginal lunules are bordered internally by a band of rich dark brown, a conspicuous feature in many specimens. The space between

the two fine terminal lines along the outer margin is typically filled with orange. Female specimens are slightly larger than the males, and have more ample wings.

Genitalia. The male genitalia (figs. 44–48) do not show any material difference from those of western specimens. An excellent figure is given by Suschkin (*loc. cit.*).

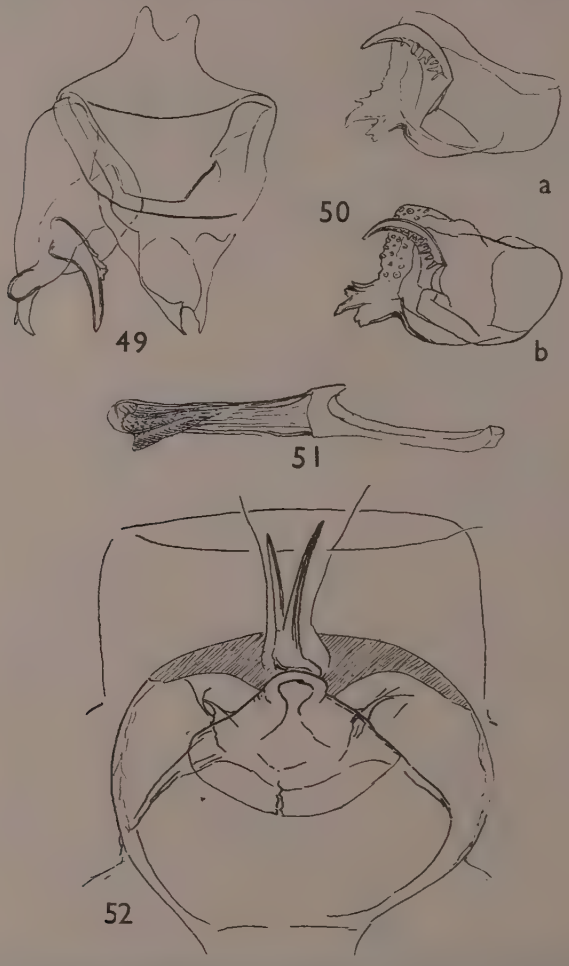
Distribution and identification. It seems certain that this insect is widely distributed in eastern Asia from the Altai Mts. to Sutschan, along the whole course of the Amur. The form *latefascia* Fixsen, described on p. 68, is slightly aberrant but probably belongs here ; the male genitalia are not distinguishable. If this form is included the species range extends to Korea. The butterfly appears to be common in the Altai Mts., where it flies with small forms of *athalia* Rott., while further east it may be confused with *centralasiae* Wnu. The characters mentioned above may be of some help in making a determination, but even with much experience I have not found it is possible to distinguish between these two butterflies without making an examination of the male genitalia. Fortunately these are most distinct.

Nomenclature. I have seen the seven specimens standing under the name *amurensis* in the Staudinger Collection. Five specimens from Sutschan are rather dark and the pattern on the upper surface is a little indistinct and abnormal. On the under surface these specimens show the very marked brown submarginal bands on the hind wings that are mentioned by Staudinger in his original description. I dissected two examples of these unusual forms and in each case the genitalia were typical of *amurensis* (*britomartis*). The other two specimens (♂ and ♀) are from Raddefskaja and are quite typical. The male of this pair is distinguished by a large label marked " *amurensis*". This example has been dissected by Verity (1940, fig. 313) but the preparation is not well mounted and does not show the tegumen nor the lateral view of the aedeagus. Fortunately the clasp is sufficiently displayed to determine the species. I hoped to obtain the preparation for remounting, but this has not been possible. This example is not suitable for specification as lectotype, as the genitalia have not been returned to Berlin with the specimen and it must be supposed that they are lost. There are no examples in Staudinger's series from Ussuri or Baical, although these localities were mentioned in the original description.

Variation. The scanty material available suggests that there may be greater variation in Siberia than is met with in Europe. Many specimens from the Altai are small with a wing-expanse of 30 mm. or less, and all were taken flying at a high altitude. These may be grouped under Verity's name of *frigidaltaica.* Examples obtained from Staudinger and labelled " Troitzkossowsk 800 m.", are larger with an expanse of 36 mm. Staudinger's original series from Sutschan show an abnormal facies, with dark ground-colour and somewhat blurred black markings, but a single specimen in this series is paler than usual with fine black markings suggesting *parthenoides*, although the genitalia are quite typical. The two examples from Raddefskaja are normal and resemble most examples in my collection from the Sajan Mts., etc.

Localities.—(All have been checked by preparations of the male genitalia.) Altai Mts. : Many specimens, including some from Staudinger labelled " Altai centr." Ongodai 3500 ft. (Coll. H. J. Elwes.) Tarbagatai Mts. : Recorded by Suschkin, said to fly with *athalia* and *aurelia.* Saour 12.vii (Brit. Mus. (Nat. Hist.)). Ural Mts. : Recorded by Suschkin flying with *athalia* and *aurelia.* Ufa, (Brit. Mus. (Nat. Hist.)). Sajan Mts. : Tunkun 2000 m. (ex. Staudinger) ;

" Sajan " ex. Coll. Oberthur. TRANSBAICAL : Troitzkossowsk 800 m. ; Tchikoi River ; Raddefskaja (Coll. Staudinger) ; Sutschan (Coll. Staudinger).



FIGS. 49–52.—*Mellicta britomartis latefascia* (Fixsen). (49) Male genitalia, dorsal view. (50) Clasp, lateral view. *a*, Korea (2) ; *b*, Korea (1). (51) Aedeagus, lateral view. Korea (2). (52) Female genitalia, dorsal view.

Mellicta britomartis latefascia (Fixsen) **comb. nov.**

Melitaea parthenie latefascia Fixsen, 1883, *in* Romanoff, *Mém. Lép.* **3** : 303. Loc. Korea.
Melitaea aurelia var. *koreana* Stgr. *in litt.*, Elwes, 1899, *Trans. ent. Soc. Lond.* **1899** : 335 (*Note*). " Like a large dark *britomartis*."
Melitaea coreae Verity, 1930, *Ent. Rec.* **42** : 82. Loc. Korea.

Note : Verity considers that Fixsen gave his name *latefascia* to specimens from Amur-

land, but this is not the sense in which I read the passage and I consider that the Korean insect was named.

Fore wing ♂ 17–19 mm., ♀ 18–20 mm.

The holotype has disappeared and no good figure exists, but after much consideration I feel that the commonly accepted attribution can be maintained for this name. The insect is compared by Fixsen with *parthenie* Borkhausen, but the black pattern is said to be heavier. In this case I am satisfied that *parthenoides* Kef. is meant, as *parthenie* Borkh. (i.e. *aurelia* Nick.) is already one of the darkest and most heavily marked species and is also considerably smaller than the dimensions recorded by Fixsen. The general confusion in the application of the name *parthenie* at the time this description was written makes the mistake quite easy to understand.

On the upper surface the comparison with *parthenoides* is most apt. On the fore wings this species is obviously recalled by the heavily marked black discal macules, while the post-discal markings are much lighter. There is a good deal of dark basal suffusion on the upper surface of both wings. On the under surface the fore wings often show clearly marked basal and discal macules but the post-discal pattern is scarcely indicated. On the hind wings the usual fine black streaks that divide the pale discal fascia are scarcely obvious or quite absent, so that the fascia appears wide and unbroken in a striking and characteristic way. Judging from available material and reports, this form, and *athalia niphona* Butler, are the only members of *Mellicta* inhabiting Korea. If this is indeed the case the name *latefascia*, on the basis of size alone, can refer only to the species now considered. The form is well characterised and recognisable at a glance by external features, and entirely unlike the forms of *athalia ambigua* Ménét. that fly also in the peninsula.

Genitalia. The male genitalia are shown in figs. 49–51. As far as I can see they show all the features of typical *britomartis*.

Distribution. There are four specimens in my collection and seven examples in the British Museum (Natural History), all from Korea. I have seen a few specimens from the Lower Amur that show the wide pale fascia on the under surface of the hind wing. No other material is available, and no precise locality is indicated. Verity (1940) shows good figures of *latefascia* from Korea in Nos. 112–116, excepting No. 113, which appears more doubtful, while his No. 6 may represent a transitional form from the Amur.

Although the external facies is so unlike ordinary *britomartis*, I have included *latefascia* with this species on account of the male genitalia which appear identical. The material available is quite inadequate to show possible transitional forms, but, from the known distribution of *britomartis* in Sutschan, an extension to the Korean peninsula appears very probable. The unusual features suggest that *latefascia* has reached full subspecific rank.

The following forms of *Mellicta britomartis* have been described and named :

aurelitoides *Melitaea melathalia* form *aurelitoides* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184, and 1931, *Mem. Soc. ent. ital.* **10** : 21, Pl. 2, figs. 15, 17 ♂ ; 16 ♀. Loc. Not specified. Large examples of the second generation with wing expanse of ♂ 31–34 mm. ; ♀ 34–38 mm. The ground-colour is of light tone and the black markings are thin.

aureliaesimilis *Melitaea melathalia* form vern. *aureliaesimilis* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184, and 1931, *Mem. Soc. ent. ital.* **10** : 18, Pl. 2, figs. 8, 10♂ 9 ♀. Name for small and slender specimens with exaggerated melanism.

dictynnaesimilis *Melitaea melathalia* form *dictynnaesimilis* Rocci, 1930, *Boll. Soc. ent. ital.* **62**: 184, and 1931, *Mem. Soc. ent. ital.* **10** : 19, Pl. 2, fig. 5, 7 ♂ ; 6 ♀. Loc. Not specified. Wing expanse : ♂ 32–35 mm. ; ♀ 37–41 mm. The ground-colour and pattern resembles *diamina aurelita* Fruhst.

imitans *Melitaea aurelia* race *imitans* Verity, 1930, *Ent. Rec.* **42** : 83. Loc. Tchita, Amur. The holotype is the specimen figured by Reverdin in 1922, *Bull. Soc. lépid. Genève* **5** : Pl. 1, fig. 4. This shows a rather dark form of *britomartis amurensis* Stgr.

marussia *Melitaea aurelia marussia* Fruhstorfer, 1919, *Arch. Naturgesch.* **83** (A) (3) : 170. Loc. Saratow. The holotype figured by Verity 1940, No. 239, shows a small dark form with the genitalia of *britomartis* (No. 315). The holotype is preserved in the Mus. nat. Hist. nat., Paris. Coll. Fruhstorfer.

parvahispanica *Melitaea athalia* race *parvahispanica* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 646. Loc. San Ildefonso and Veruela, Spain. This name was given by Verity to the examples figured by Agenjo in 1933, *Eos, Madr.* **9** : Pl. 10, fig. 4, and Pl. 11, fig. 6. These are examples of *britomartis* from the Vazquez collection. I am informed by Senor Agenjo that he considers the data of these specimens unreliable. Neither was taken in Spain by Senor Vazquez. No other examples of *britomartis* have been found in Spain and it is improbable that the species occurs in that country. No precise racial characters were defined by Verity when the name was published.

parvaurelia *Melitaea melathalia* form aest. *parvaurelia* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 184, and 1931, *Mem. Soc. ent. ital.* **10** : 20, Pl. 2, fig. 18 ♂ ; 10 ♀. A name for the very small specimens of the second generation with wing expanse ♂ 24–26 mm. ; ♀ 25–27 mm.

postmelathalia *Melitaea melathalia* form aest. *postmelathalia* Rocci, 1930, *Boll. Soc. ent. ital.* **62** : 20, figs. 11, 13 ♂ ; 12, 14 ♀. A name for the smaller and less melanic second generation of *melathalia*. Wing expanse ♂ 29–31 mm. ; ♀ 30–33 mm.

pygmea *Melitaea athalia* var. *pygmea* Hormuzaki, 1923, *Z. wiss. InsektBiol.* **3** (Beilage) : 11. Loc. Roumania. Text-fig. of male genitalia. The figure is not well drawn but it shows the characteristic long tegumen of *britomartis* and I feel sure it can be safely placed as a specimen of the second generation of this species.

segusiana *Melitaea britomartis segusiana* Rocci. This is mentioned by Verity (1940) and the reference given is 1932, *Mem. Soc. ent. ital.* **11** : 38. The name is mentioned on p. 39 of this periodical, but I cannot find any description, and it appears to be *nomen nudum*.

MELLICTA PLOTINA (Bremer) **comb. nov.**

Melitaea plotina Bremer, 1861, *Bull. Acad. Sci. St. Pétersb.* **3** : 544. Loc. Bureja Mts. and Ussuri.

Melitaea britomartis var. *plotina* Bremer, 1864, *Lep. Ost-Siberiens* : 14, Pl. 3, fig. 2.

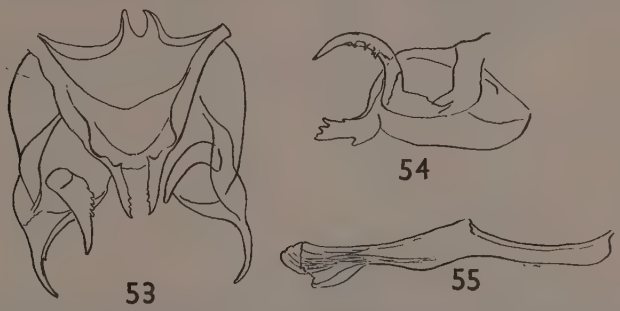
Melitaea pacifica Verity, 1932, *Ent. Rec.* **44** : 71. Loc. Trans-baical—Troitzkossowsk 800 m. Fig. Verity 1940, figs. 1, 2.

The holotype cannot be traced, but the specific features are sufficiently distinctive to be easily recognised from Bremer's original description and well-drawn figure. Dr. Verity has suggested re-naming this species on the ground that the figure given by Bremer does not show the insect usually known as *plotina*. I cannot agree with this suggestion, and Bremer's figure appears to me to show the special characters of *plotina* quite clearly. I have no doubt of of its identity and the commonly accepted application of the name is correct. Other authors, e.g. Suschkin and Hormuzaki, have not had difficulty in making their identification.

Fore wing ♂ 14–16 mm., ♀ not seen.

In the male the long and narrow wings are noticeable. On the upper surface the ground-colour is vivid orange, often rather dark. The usual black markings are thick and sometimes the orange macules are almost obliterated along the outer margins of both wings. The discoidal stigma is commonly set obliquely, not at right-angles with the cell. On the under surface the hind wings are strongly marked, with the pale discal macules standing in vivid contrast with the intense brown suffusion of the submarginal area. The female specimen shown on Pls. I and II, fig. 7, is doubtfully referred to this species.

Genitalia. The male genitalia are distinct (fig. 53). The tegumen shows rather short, strong sub-uncal processes, with several small teeth along their inner margins. In lateral view the clasp (fig. 54) shows a long posterior process with three or four terminal teeth and a single tooth on the inferior margin. The harpe shows a few small teeth. The aedeagus (fig. 55) is relatively straight, with a slender neck, and the usual ostium crest and folds are rather featureless. The characteristic clasp was figured by Hormuzaki (1934) and by Suschkin (1913). No female specimen is available for examination of the genitalia.



Figs. 53–55.—*Mellicta plotina* (Bremer). (53) Male genitalia, dorsal view. "Amur". (54) Clasp, lateral view. "Amur". (55) Aedeagus, lateral view.

Distribution. Not much is known of this butterfly. I have examples labelled "Amur" and "Ussuri" and from Charborowka at the junction of the two rivers. These localities correspond with Bremer's original reports of capture in the Bureja Mountains. I have also a short series of recent specimens received from Staudinger and labelled "Troitzkossowsk, Transbaicalia, 800 m." This locality is very far from all others yet reported and I feel it should be accepted with some reserve. Verity's name *pacifica* is clearly founded upon an example from the same series.

MELLICTA ASTERIA (Freyer) **comb. nov.**

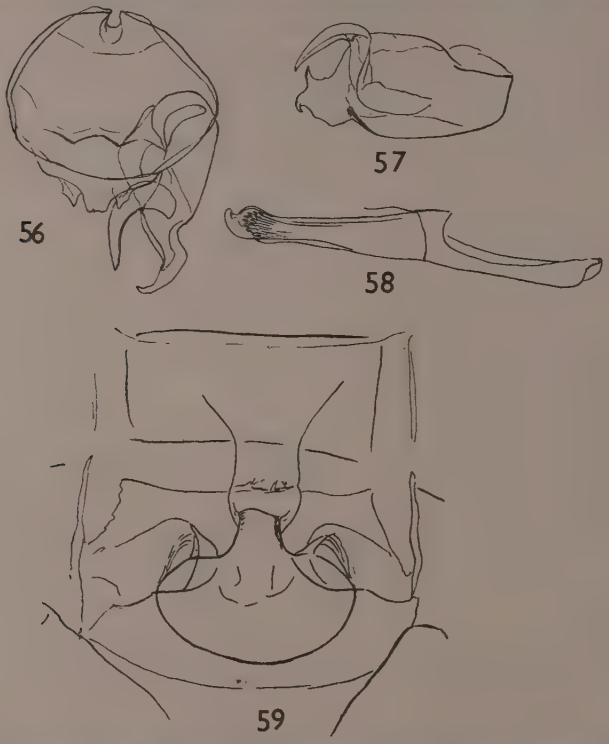
Papilio (*Melitaea*) *asteria* Freyer, 1828, *Beitr. europ. Schmett.* 1 : 115, ; Pl. 36, fig. 1. Loc. "Chur" Switzerland (ex errore ?).
Melitaea asterie Herrich-Schaeffer, 1843, *Schmett. Europ.* 1 : 23, Pl. 1, figs. 3, 4.

No holotype can be traced, but the species is easily recognisable from Freyer's excellent figure.

Fore wing ♂ 13–14 mm., ♀ 14 mm.

On the upper surface the wings are dusky and the basal area entirely black. The marginal lunules are relatively large and the submarginal series of orange macules in a deeper

tone is usually distinct. A prominent oblong orange macule is present on the fore wing at the end of the cell. The under surface is pale. On the fore wing the large marginal lunules are almost white and correspond with the ground colour of the hind wings. The disc of the fore wing is orange with the macules of the black median fascia prominent. There is a single black terminal line around the outer margins of both wings. This description applies to the male. In the female the dark suffusion on the upper surface is grey rather than black, and the markings are all paler. There is often marked contrast between the orange macules of the submarginal fascia and the pale post-discal and marginal macules.



FIGS. 56–59.—*Mellicta asteria* (Freyer). (56) Male genitalia, dorsal view. Albula. (57) Clasp, lateral view. Albula. (58) Aedeagus, lateral view. Albula. (59) Female genitalia, dorsal view.

The small size, the darkly suffused upper surface and the single terminal line along the wing-margins on the under surface, all make this little species unmistakable. There are some points of similarity between *asteria* and the oriental *menetriesi*, although the latter is a larger insect. The larva is figured by Spuler, *Nachtr.* Pl. 1. Little is known of the early stages.

Genitalia. The male genitalia (fig. 56) are small, with the tegumen, vinculum and sternite united to form an almost circular ring. The narrow tegumen shows a small lateral process on each side. In lateral view of the clasp (fig. 57) the posterior process terminates in a sharp point that is curved strongly inwards. Above this is a strong tooth. The stout

harpe is nearly hidden and almost or quite devoid of teeth. The aedeagus (fig. 58) is short, the ostium-keel partly hidden by a delicate fold.

The shape of the posterior process of the clasp confirms a near association with *menetriesi*, and also with *aurelia*, *rebeli*, *amurensis* and probably *alatauica*.

Variation. This appears to be a constant species. In a series from the Albula there is slight variation in the degree of black shading on the upper surface. In some specimens all the discal marks are obliterated and only the orange submarginal series and the marginal lunules remain distinct. In worn female specimens the macules become very pale, almost white. Examples from the Gross Glockner have been distinguished by the name *mevania* Fruhstorfer (1910, *Ent. Z.* **24** : 144) and are said to be darker than typical specimens. This may be true if long series are compared, but in a majority of specimens no distinction can be made.

Distribution (Map 1). *M. asteria* is confined to the eastern Alps of Europe, where it flies at altitudes of 6000 ft. or more, that is to say it always appears above the tree-line in true alpine conditions, and then occurs up to the snow-line. The following well-known localities may be mentioned :

Switzerland : On the high mountains on both sides of the Engadin valley, e.g. Davos, St. Moritz, Pontresina (?), Albula Pass ; (possibly first discovered in this locality) ; Guarda on the Wildspitz. Austria : Brenner District (up to 8000 ft.) and then east on many high mountains to the Gross Glockner. I have seen no records east of this mountain. It is doubtful whether *asteria* flies in Switzerland west of the Engadin valley. Freyer's locality of Chur is clearly wrong, and this was possibly the home of Herr Wredow, from whom he received the specimens. There are no high alps in that area. I have no doubt the butterflies were caught in the Engadin, very likely on the Albula Pass, where the insect is common, flying with *Erebia manto pyrrhula*.

No subspecies are recognised.

MELLICTA REBELI (Wnukowsky) **comb. nov.**

Melitaea asteria var. *altaica* Staudinger, 1901, *Cat.* Ed. 3 : 34 Loc. Altai, Tchuja. nec *Melitaea didyma altaica* Groum, 1893.

Metitaea asteria rebeli Wnukowsky, 1929, *Zool. Anz.* **83** : 222. nom. nov. pro *altaica* Stgr., 1901, nec Groum 1893.

Plates I, II, figs. 14, 15.

Staudinger's name was founded upon specimens taken at Tchuja in the Altai Mts. by Elwes and recorded as " var. nova " (1899, *Trans. ent. Soc. Lond.* **1899** : 334). Elwes' specimens are still preserved in the British Museum (Natural History).

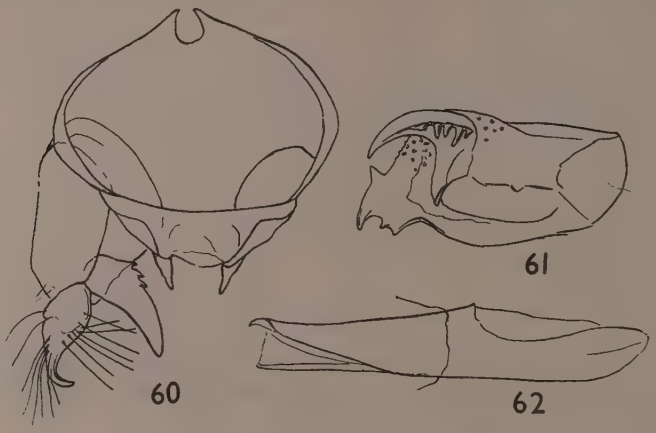
Holotype ♂ B.M. No. 8335 ; Allotype ♀ B.M. No. 8336. 4 paratypes.

Fore wing ♂ 14 mm. ; ♀ 16 mm.

In this species the fore wing is wide, the outer margin rounded. On the upper surface the ground-colour is pale with a distinct yellowish tone. All the usual markings are present and rather heavy, with considerable suffusion of black scales at the wing-bases. On the under surface the usual pattern is present, the terminal line double and the discal stigma rather small. The female, of which I have a single specimen, closely resembles the male with slightly longer and rounder wings.

Genitalia. The male genitalia (fig. 60) are large for the size of the insect and very distinct. The tegumen (one example examined) shows well-marked sub-uncal processes. In dorsal view the posterior process of the clasp is strongly hooked inwards. In lateral view (fig. 61) the process shows a single tooth upon the upper border, a long curved terminal spine and two small secondary teeth below it. The massive harpe shows the usual series of teeth. The aedeagus (fig. 62) is stout and terminates abruptly in a sharp point, slightly hooked downwards. This is quite unlike the form in any other species.

Distribution. *Mellicta rebeli* is known only from the high summits of the Altai and Sajan mountains. Elwes gives the altitude of his specimens as 8000 ft., and they are all from the Tchuja Mts. I have one pair labelled Tunkinsk Weissberge, in the eastern Sajan Mts., with the altitude of 6000 ft. recorded.



Figs. 60–62.—*Mellicta rebeli* (Wnukowsky). (60) Male genitalia, dorsal view. (61) Clasp, lateral view. (62) Aedeagus, lateral view.

MELLICTA ALATAUICA (Staudinger). **comb. nov.**

Melitaea parthenie var. *alatauica* Staudinger, 1881, *Stettin. ent. Ztg.* **42** : 291. Loc. Ala-tau Mts.
Melitaea athalia alatauica Seitz, 1909, and Fruhstorfer, 1917.
Melitaea athalia fruhstorferi Wnukowsky, 1929, *Zool. Anz.* **83** : 222. Nom. nov. pro *athalia alatauica* Seitz, 1909, nec *parthenie alatauica* Stgr., 1881.

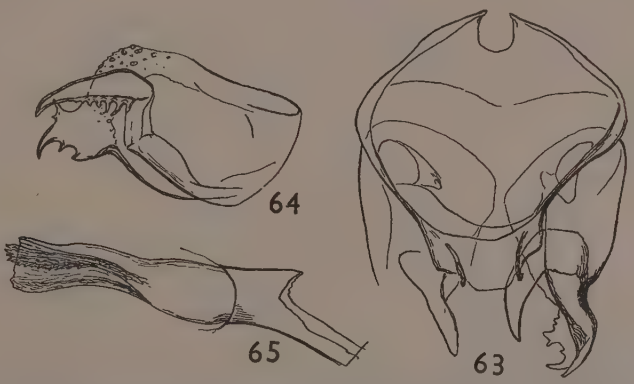
The male lectotype is preserved in the Coll. Staudinger in Berlin.
Figs. Verity 1940, Nos. 192, 196, 197. The figures in Seitz are not good.

Fore wing ♂ 17–18 mm. ; ♀ 19 mm.

The fore wing is narrow and pointed. In the male on the upper surface the ground-colour is bright orange with the usual black markings very well defined. On the hind wing the discal area is unmarked except for the black scaled nervures and there is a clear orange area internal to the disco-cellular stigma. On the under surface the marking of the hind wing is rather striking with bold contrast between the pale ground-colour, the orange macules and the deep black nervures. I have a single specimen of the female which is rather larger than the male, with yellowish scales in some macules of the fore wing.

Genitalia. The male genitalia are distinct (fig. 63). The tegumen shows a thickened strip on each side, but there is no projecting sub-uncus in either of two specimens examined, nor does this appear in Verity's preparations. The posterior process of the clasp (fig. 64) recalls that of *aurelia*. The long terminal spine is curved inwards with a slightly smaller tooth upon the superior border and two secondary teeth below, both of which are strongly turned inwards. The aedeagus (fig. 65) shows a long conspicuous morula armed with many teeth. The curved shaft terminates abruptly in a small ostium-keel, quite unlike the organ in *aurelia*.

Distribution. So far as I know this species is confined to the Dzungarian Ala-tau. It is rare in collections, and with few specimens available it is not possible to describe the extent of variation, but in five male examples in my collection this is very slight. I have seen only old specimens with such data as "Tura"; "Siberia" and, more rarely, "Ala-tau." The genitalia were figured by Suschkin (1913), who gave as a locality "Kopal." The general facies of the species would agree with an alpine habitat.



Figs. 63–65.—*Mellicta alatauica* (Staudinger). (63) Male genitalia, dorsal view. Ala Tau, no further data. (64) Clasp, lateral view. Ala Tau. (65) Aedeagus, lateral view. Ala Tau.

Note.—This species is interesting in the lack of a definite sub-uncus. This is a character of the western species group which is shared among Asiatic forms only by *M. aurelia distans* from Tekkes. Other isolated forms appearing in the Ala-tau include *M. pseudoala* Shelj. and possibly *E. alexandrina* Stgr., the latter appearing also in the Thian-shan in the same region as *aurelia*. These butterflies appear out of place in Central Asia far from other members of their generic groups and may possibly represent a relict fauna more closely related to western European forms.

MELLICTA AURELIA (Nickerl) **comb. nov.**

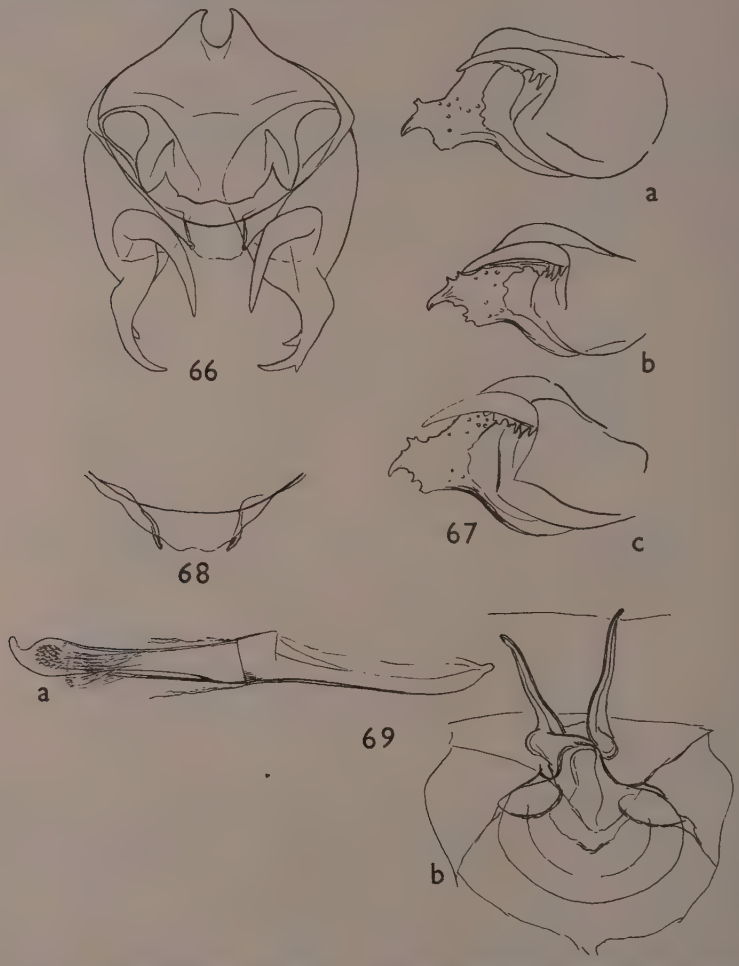
Papilio athalia minor Esper, 1784, *Die Schmett.* **1** (2) : 173, Pl. 89, fig. 1, 2. Loc. Erlangen, Germany.

Papilio parthenie Borkhausen, 1788, *Naturg. europ. Schmett.* **1** : 53 nec *Papilio parthenie* Bergstrasser, 1780.

Melitaea aurelia Nickerl, 1850, *Syn. Lep. Fauna Bohmens* : 12. Nom. nov. pro *P. parthenie* Borkhausen, 1788, nec *parthenie* Bergstrasser, 1780.

No holotype is available now, but Esper's figure is excellent and the usual specific determination may be accepted, as *britomartis* has not been recorded so far west as Erlangen.

Three sub-species are recognised.



Figs. 66–69.—*Mellicta aurelia* (Nickerl). (66) Male genitalia, dorsal view. Bulgaria. (67) Clasp, lateral view. *a*, Berisal (1); *b*, Berisal (2); *c*, Varnik, Thrace. (68) Tegumen, Oulz, Piedmont. (69) *a*, Aedeagus, Oulz, Piedmont; *b*, Female genitalia, Oulz.

Figs.: Meyer-Dür, 1851, *Verz. schweiz. Ins.*, fig. 1, 2. Spuler, 1908, *Schmett. Europ.*, Pl. 7, fig. 6. Verity 1940, figs. 147–171.

Nomenclature. There has been confusion in the literature regarding the correct name for this insect. Esper's descriptive name was not acceptable

and the butterfly he described and figured was named *parthenie* by Borkhausen in 1788. Unfortunately this name is not valid ; it is a primary homonymn of *Papilio parthenie* Bergstrasser, 1780 (= *B. ino* Rott.). In the early years of the nineteenth century there was much confusion between this insect and the allied species from France and Spain also referred to *parthenie* by Godart. It was not long before the correct distinction was made by Keferstein (1851, *Setttin. ent. Ztg.* **12** : 242) and Heydenreich (*Verzeichniss*, 1851) and especially by Meyer-Dür (*Verzeichniss*, 1851). Borkhausen's homonymn was corrected by Nickerl, who introduced the name *aurelia* in 1850 as *nomen novum* in place of the preoccupied *parthenie* of Borkhausen. Unfortunately, in 1940, Verity attempted to reinstate *parthenie* as the correct specific name, but this action is indefensible. Nickerl's name of *aurelia* is perfectly valid and quite properly it has been accepted by all authors since its introduction.

Fore wing ♂ 15–18 mm. ; ♀ 16–18 mm.

This is a species of small size and neat, compact habit. On the upper surface the ground-colour is tawny-orange, with regular and complete black markings. On the fore wing the discal spots are well formed and those in cellules 5, 6, 7 and 10, which make the costal bar, are placed in a gentle curve at right angles to the costa. On the under surface also the markings are generally complete, with the discal series of black macules boldly marked and the post-discal series only faintly indicated. The markings of the hind wing are not distinctive. In the female on the upper surface the ground-colour is sometimes yellowish, but sexual dimorphism is not marked.

Genitalia. In the male (fig. 66) there is a simple tegumen sometimes with rudiments of sub-uncal processes. In lateral view the clasp (fig. 67) is oval with the posterior process short, wide and curved medially. It terminates in a sharp point with a single prominent tooth arising from the superior border and some irregular dentations below. The harpe is short and shows few teeth. The aedeagus (fig. 69) is characteristic. The shaft is straight and sharply upturned at its termination, with a conspicuous spiny morula. This feature is well shown by Suschkin and by Hormuzaki. The female genitalia (fig. 70) are of the usual type, with the specific characters little obvious. The ventral plate is small and the sterigma very compact, evenly rounded posteriorly, and the whole structure looks unusually neat.

Early stages. The egg as figured by Urbahn is slightly smaller and rounder than that of *athalia*. The larva has been described many times in general terms. According to Wheeler (1910, *Entomologist* **43** : 336) the size is small and the general appearance is grey with brownish spines, white at the tip. The first accurate description and figure is given by Urbahn (Pl. 13A, fig. 2), showing a very dark ground-colour, with a number of very small white points. The dorsal line is not conspicuous and the lateral lines are not developed. It is darker than the larva of *athalia*. The orange or reddish spines stand upon yellow macules, and they are white at the tips. The pupa is white with chocolate-brown markings, and orange and yellow spots, arranged in a characteristic pattern (Pl. 14, fig. C). Urbahn states that the eggs are often laid in clumps on single leaves of *Veronica spicata*, but he fed them later upon *Plantago*, which is certainly a normal food-plant.

Identification. Through most of its distribution area *M. aurelia* is associated with *athalia* Rott. and with *britomartis* Assmann. It is not usually difficult to distinguish from *athalia*, which is a larger insect with a more irregular black pattern upon the upper surface. Separation from *britomartis* is more difficult. In some cases, especially when it is known that both species occur together.

britomartis can be separated with a fair degree of confidence by the rounder fore wings and the strong markings on the under surface of the hing wings. In *M. aurelia* the fore wings are narrower and the markings on the under surface are less striking. In all cases of difficulty examination of the male genitalia will be needed.

Distribution (Map 2). *M. aurelia* is widely distributed in central and eastern Europe, including the Balkans. In the west it extends into northern France in the neighbourhood of Paris and from there it spreads into Germany, Switzerland and Italy in the foothills on both sides of the valley of the Po. In the north it has been recorded certainly from the extreme south of Sweden (Petersen, 1945). Further east I have reliable records from several localities in central Russia as far as the Urals, but material from this region is so poor that no attempt can be made to define the distribution. Slightly unusual forms described below indicate an extension into the Caucasus and southern Central Asia. Everywhere the insect appears sporadically in small colonies, often widely separated and quite localised. The absence of sub-uncal points suggests western affinities, but the species scarcely crosses west of the Rhine and does not encroach upon the distribution area of the true western Group. The following localities can be accepted ; most have been checked by examination of the genitalia.

France : Here and there in the Departments of Aisne ; Oise ; Vosges ; Hte. Rhin ; Indre ; Cher ; Sarthe ; Ht. Marne. Belgium : I know it only from Virton. Germany : Generally common in southern Germany and a most characteristic insect of the great peat mosses of Bavaria, e.g. Aschau in Priental ; around the Schliersee ; etc. Less common in Brandenburg, West Prussia and Posen (Urbahn 1939). Austria : Common and widely distributed. Sweden : Recorded only from Skåne. Poland ; Hungary ; Roumania : it certainly occurs, but I have not seen specimens. Italy : Appears not uncommonly in northern Italy in the foothills of the Alps and at subalpine levels ; e.g. Oulz, Susa, Val d'Aosta, around the Lakes of Como, Maggiore, Garda ; also in the Dolomite Valleys, e.g. Val Cordivole ; Val Perarina ; Val Travaglia (L. Rocca). Rare and local on the south side of the Po valley, e.g. La Mussina, Modena in Emilia. Balkans including Greece : I have seen specimens from Slivno, Chamkuria and Kostenetz in Bulgaria ; from the Musalla Mountains in Macedonia and from Jaice in Bosnia. Reported by Rebel from Hercegovina and Serbia—Serajevo ; Jablanica ; Vucija Bara, Prozor, etc. Also from Varnik in Thrace. Switzerland : Frequent in the Cantons of Valais, Grisons and Tessin, especially at low or moderate elevations. It ascends to about 5000 ft. at Berisal on the Simplon Pass. Recorded by Vorbrodt as occurring throughout Switzerland. Russia : Podolia (Blagowitza) ; Charkow ; Southern Urals (*fide* Suschkin) ; Petrograd ; Kasikaporan. Asia : Not seen from Siberia. Three specimens from Tekkes in Turkestan described below, as *M. aurelia distans* nov. Caucasus : Occurs in the subspecies *albimacula* Nies.

Variation. Many striking aberrations of the *aphaea–corythalia* series have been described by Oberthür and others, and there are 13 examples of *aphaea* forms in the British Museum. I have seen such specimens from France and Germany, but not from southern localities. Osthelder (1925, *Mitt. münch. ent. Ges.* **15** (Beilage) : 89) suggests that these are particularly common in certain localities, e.g. the moor near Abendsberg in Bavaria, perhaps on account of the

extreme climatic changes in the district, and adds that marked aberrations are common only in certain years. Environmental variation is less marked. The typical rather dark form described by Esper appears in many localities in western Germany and further east. Other colonies show a high proportion of very dark examples. This is especially true of series from the Bavarian peat moors named *valsunga* by Fruhstorfer. Osthelder (*loc. cit.*), who gives several good figures of dark modifications, refers such specimens to *britomartis* and states that the larvae in Bavaria are always greyish-white instead of black as in true *aurelia* (*Lenz, F.*, 1917, *Mitt. munch. ent. Ges.* **8** : 29). My own Bavarian specimens are all *aurelia* and as far as I know *britomartis* has not been recorded so far west. In the Jura Mts., in Switzerland and in many southern localities, slightly paler forms predominate. The most suitable name for these pale modifications appears to be *rhaetica* Frey, described from low altitudes in Chur. Very bright forms with delicate black pattern appear in northern Italy, and these have received several names, of which *mendrisiota* Fruhstorfer probably represents the most extreme pale form, but the distinction from *rhaetica* is difficult to maintain. Pale examples occur in the Balkans, but the few examples that I have seen from southern Russia have been dark or very dark.

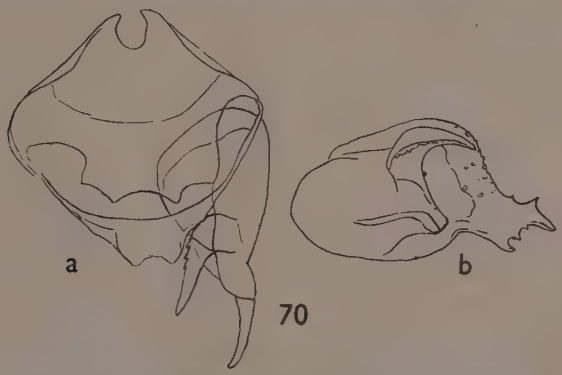


Fig. 70.—*Mellicta aurelia albimacula* (Niesiowski). *a*, Male genitalia, dorsal view. Caucasus. *b*, Clasp, lateral view. Caucasus.

1. *M. aurelia albimacula* (Wojlusiak & Niesiowski) **comb. nov.**
Plates I and II, fig. 18.

Melitaea aurelia Nickerl subsp. *albimacula* subsp. n. Wojlusiak, R. J. & Niesiowski, W., 1946, *Polsk. Akad. Przorod.* **6** : 55, Pl. 1, fig. 14. (*Lepidoptera of the Central Caucasus.*)

Fore wing ♂ 14 mm.; ♀ 27–28 mm.

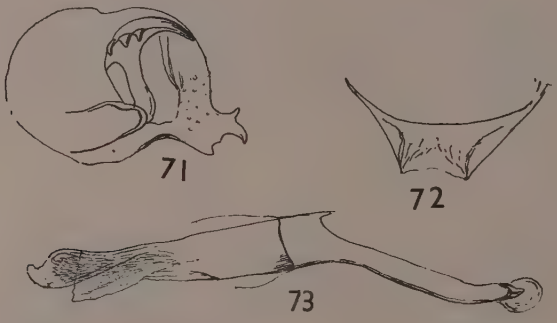
On the upper surface the pattern is strongly melanic, with the basal half of the hind wing and the inner margin of the fore wing black. The usual orange markings are somewhat reduced by the suffused black pattern. On the under surface the basal and discal markings are well-developed on the fore wing but there are few markings in the distal area. On the hind wing the basal macules and discal fascia are chalk-white with yellowish border and marginal lunules.

Genitalia. The male genitalia (fig. 70, *b*, *c*) are typical of *aurelia*, with the exception of the aedeagus, which shows a shorter apex than usual, and is similar to the organ in *aurelia*

distans (see fig. 73). Unfortunately the organ was distorted in preparation of the specimen figured, and no useful drawing of the aedeagus of *albimacula* can be given.

Localities.—Central Caucasus: Bilagi-Don 2000 m., 25.vii; Uruch valley, 1500 m.; Karangom, 2400 m. Fairly numerous in July on alpine and sub-alpine meadows.

The description is taken from two male paratypes presented to the British Museum (Natural History) Collection by R. Wojlusiak. A female specimen from the same locality included with these is clearly referable to *athalia*. This form appears most distinct by the brilliant contrast on the under surface of the hind wings between the chalk-white macules and the rather dark orange-brown fasciae, while the large black discal macules are conspicuous on the fore wing.



Figs. 71–73.—*Mellicta aurelia distans* subsp. n. (71) Clasp, lateral view. Tekkes. (72) Tegumen. Tekkes. (73) Aedeagus. Tekkes.

2. *M. aurelia distans* subsp. n. Plates I and II, fig. 13.

Fore wing ♂ 16 mm., 17 mm.; ♀ 18 mm.

In the male on the upper surface this form is brightly marked with the black pattern slightly irregular but well spaced, so that the orange macules stand out clearly. On the fore wings the black discal series is heavy, with a large solid black spot in cellule 1b in both specimens, and the costal bar is distinctly angled with the macules in cellules 4 and 5 displaced distally. On the under surface the disc of the fore wings is orange with the discal black macules enlarged. The ground-colour of the hind wings is pale yellow, almost white, showing marked contrast with the orange discal and submarginal fasciae. The latter is narrow, scarcely, if at all, wider than the submarginal orange lunules and the usual black discal striae are nearly obsolete in all specimens, so that there is a wide band of pure white before the submarginal fascia. In one specimen the marginal lunules near the apex of the fore wing are also very pale. In the female the ground-colour is slightly paler, on the upper surface with traces of yellow near the costa of the fore wings. On the under surface the contrast between the pure white ground-colour of the hind wings and the orange fasciae is most striking.

Genitalia. The male genitalia (figs. 71, 72 and 73) resemble European examples except in one small feature. The ostium crest of the aedeagus, in lateral view, is shorter in both specimens than I have ever found it in western examples.

This form is described from two male specimens and a single female specimen taken by Ludlow in the Tekkes Valley (approximately 43° N. lat. 80° East) in the north-western Thian-Shan. It is the only species of the genus known at present to occur in these mountains, and extends the distribution of *aurelia* from the Ural Mts. to the Central Asiatic region. It seems unlikely that the butterfly can survive in the dry country north and west of the Thian-Shan, and it is quite possible that the colony is now isolated. The characteristic *Mellicta* of Siberia all show a well-developed sub-uncus, and this group is not known to extend into the Central Asiatic region. In *M. aurelia* there is no sub-uncus and this fact suggests rather an association with the species with a similar tegumen now surviving in western Europe. I believe that these forms are members of an ancient stock partly displaced by the later Euro-Siberian species during a Post-Glacial immigration. The present discontinuous distribution of *aurelia* and its associates tends to confirm this view.

I am indebted to Lt.-Colonel F. M. Bailey for the three specimens upon which this description is based, and for the details of their capture. The male holotype and female allotype with the genitalia preparations are now in my collection.

Several authors have gone to great lengths in defining local races of this species. The result is a confused assembly of names as recorded below, most of which mean very little. My material from western Europe suggests two definite modifications, the darker forms of northern Europe and the paler modifications met with in the southern Alps. In all cases there is so much individual variation that any attempt at precise definition becomes exceedingly difficult.

The following forms of *Mellicta aurelia* have been described and named :

aurelia-nigrobscura Verity, 1931, *Ent. Rec.* **43** : 187. Loc. Vienna. This name was suggested for a series showing marked contrast between the palest and darkest examples, but there is no further description. Not figured by Verity 1940.

carsicola *Melitaea parthenie* Borkh. race *carsicola* and gen. 2 *post-carsicola* Verity, 1932, *Ent. Rec.* **44** : 29. Loc. Opcina, 300 m. on the Carso above Trieste. The ground-colour is clear fulvous and the black pattern is not heavy. The first generation is very large, the second generation smaller and paler. Figured by Verity 1940, Nos. 163–165. Genitalia are not illustrated.

charlotta *Melitaea aurelia* ab. *charlotta* Rebel, 1912. See p. 96.

corythalina *Melitaea aurelia* ab. *corythalina* Rebel, 1913. See p. 97.

imitatrix *Melitaea parthenie* Borkh. race *imitatrix* Verity, 1932, *Ent. Rec.* **44** : 28. Loc. Oulz and Monte Musine, Piedmont. On the upper surface the ground-colour is rich fulvous and the black markings are rather heavy. It is difficult to pick out the salient features from the description. This does not apply well to my own examples from Oulz, in most of which the black markings are thin. Figured by Verity 1940, Nos. 168–169.

ligustica *Melitaea britomartis* Assmann race *ligustica* Rocci, 1932, *Mem. Soc. ent. ital.* **11** : 37 and (genitalia) 143, 144 (fig. 5). Loc. Val Bisagno, Ligurian Appennines. From the description it is not clear to me in what way this form differs from others found south of the Alps. The ground-colour is pale and the black markings are fine.

lacustris *Melitaea britomartis* razza *lacustris* Rocci, 1932, *Mem. Soc. ent. ital.* **11** : 39 and (genitalia) 143, 144 (fig. 6*b*). Loc. Lake Garda. Rather small with pale ground-colour and fine black pattern. The racial characters of *lacustris* seem quite indefinite.

lucasi *Melitaeap arthenie* Borkh. race *lucasi* Verity, 1920, *Bull. Soc. ent. Fr.* **1920** : 272. Loc. Moreuil, Dept. Oise. A small form with rather pale ground-colour and not heavily marked. Holotype figured by Verity 1940, No. 156. Later Verity refers this to the nominotypical *parthenie* Borkhausen (1940 : 668).

luceria *Melitaea aurelia luceria* Fruhstorfer, 1917, *Arch. Naturgesch.* **82** (A) (2) : 11. Loc. Cogne, Val d'Aosta. Large and brightly marked specimens.

mendrisiota *Melitaea aurelia mendrisiota* Fruhstorfer, 1919, *Arch. Naturgesch.* **83** (A) (3) : 175. Loc. Monte Generoso. A pale and lightly marked dry form. Similar examples occur in many localities in northern Italy. (See also *lacustris* Rocci ; *carsicola* Verity ; *mussinae* Costantini.)

melanodes *Melitaea aurelia* ab. *melanodes* Lambillon, 1910. See p. 100.

micromelanica *Melitaea parthenie* Borkh. race *micromelanica* Verity, 1935, *Ent. Rec.* **47** (Suppl.) : 73. Loc. Pfynwald, Switzerland. Said to be intermediate between typical *aurelia* and *valsunga*. Figs. Verity 1940, Nos. 150–151.

mussinae *Melitaea aurelia* Nick. var. *mussinae* Costantini, 1916, *Atti Soc. nat. Modena* (5) **3** : 14. Loc. Borzano, Emilia. A large form with rounded wings and bright fulvous ground-colour. Figured by Verity 1940, Nos. 166–167 from paratypes. I have not seen this form myself.

nigrobscura *Melitaea parthenie* (Borkh.) race *nigrobscura* Verity, 1931. *Ent. Rec.* **43** : 155. Loc. Herrsching, Southern Bavaria. A name for the large and dark forms figured by Osthelder, *Schmett. Sudbayerns*, Pl. 3, fig. 1–3.

poenina *Melitaea parthenie* (Borkh.) race *poenina* Verity, 1931, *Ent. Rec.* **43** : 188. Loc. Berisal, Valais. Said to be intermediate between typical *aurelia* and *rhaetica* Frey, but too variable to describe further. Figs. by Verity 1940. Nos. 159–162.

pyronioides *Melitaea aurelia* ab. *pyronioides* Reuss, 1921. *Int. ent. Z.* **15** : 5. No locality given. See page 102.

rhaetica *Melitaea aurelia* var. *rhaetica* Frey, 1880, *Lep. Schweiz* : 30. Loc. Chur, Switzerland. The description runs as follows : " Das Thier, naturlich einem gewissen Wechsel unterworfen, kleiner, lebhafter rothbraun, weniger trub, mit feinerem schwarzen Zeichnungen, das Weib nicht selten mit sehr lichten braunen Fleckenreihen (var. *Rhaetica*)." This may be accepted as the first description of the bright and lightly marked forms that appear in most southern localities. The holotype ♂ and 3 ♂ and 5 ♀ paratypes are now in the British Museum (Natural History).

segusiana *Melitaea britomartis* razza *segusiana* Rocci, 1932, *Mem. Soc. ent. ital.* **11** : 38. Loc. Susa. " Rocci says that he delayed the publication of this name since he knew that I had already described the form " (Verity 1940). I cannot find any description in reference given.

valsunga *Melitaea aurelia valsunga* Fruhstorfer, 1919, *Arch. Naturgesch.* **83** (A) (3) : 172. Loc. Barmsee, Bavaria. A name for the small and dark examples that occur so commonly on the Bavarian moors. In my experience these are commonly associated with *athalia suessula* Fruhst., another small and dark form.

verbanica *Melitaea britomartis* Assm. razza *verbanica* Rocci, 1932, *Mem. Soc. ent. ital.* **11** : 39 and (male genitalia) 152. Loc. Valtravaglia near Lake Maggiore. A large form with intense fulvous ground-colour and strongly marked black pattern. Figs. Verity 1940, Nos. 170–171,

vividocolore *Melitaea parthenie* (Borkh.) race *vividocolore* Verity, 1931, *Ent. Rec.* **43** : 186. Loc. Kisnyir, Hungary. The fulvous ground-colour is very bright and the black pattern thin. Described from a single specimen and figured by Verity 1940, No. 152. It does not appear that the genitalia were examined.

MELLICTA CENTRALASIAE (Wnukowsky) **comb. nov.**

Melitaea aurelia var. *mongolica* Staudinger, 1892, *Iris* **5** : 327. Loc. Kentei Mts.
Melitaea aurelia centralasiae Wnukowsky, 1929, *Zool. Anz.* **83** : 222. Nom. nov. pro *aurelia mongolica* Stgr., 1892 (p. 327) nec *maturna mongolica* Stgr., 1892 (p. 321) ; page priority.
Melitaea aurelia race *mongolicola* Verity, 1930, *Ent. Rec.* **42** : 83. Nom. nov. pro *aurelia mongolica* Stgr. praeocc.
Figs. Verity 1940, Nos. 117, 118, 119, 121, 306, 307, 308, 309, 310 (genitalia).

Male lectotype selected from the original series by the writer. It is now returned to the Zoological Museum, Berlin.

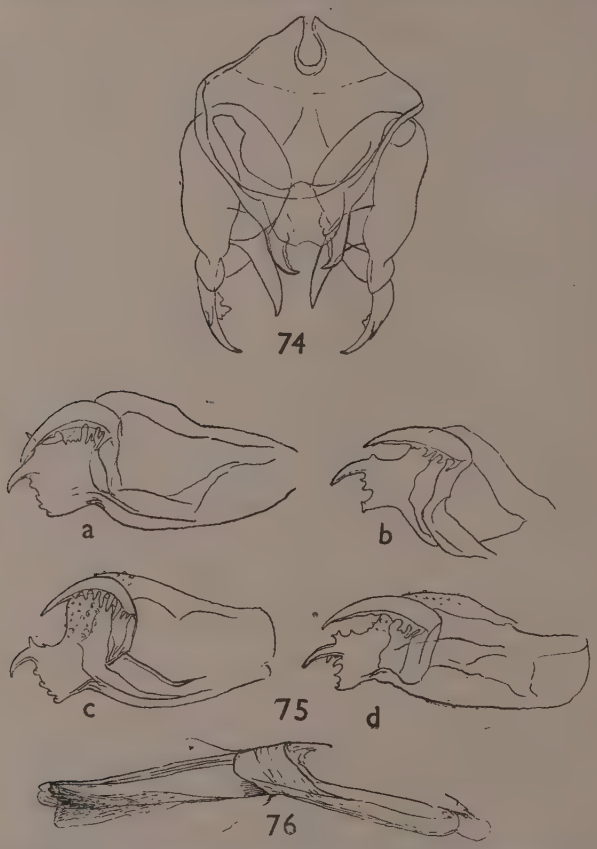
Fore wing ♂ 14–18 mm. ; ♀ 16–18 mm.

On the upper surface of the fore wing the standard markings are usually bright and clear. The post-discal and submarginal macules and the orange marginal lunules are mostly of equal size, so that the pattern appears very regular. On the hind wings there is often a dark basal suffusion which encloses a round orange spot in the cell. On the under surface of the fore wing the post-discal series of black macules is often complete. The hind wing shows no special characters. In external appearance this species is probably indistinguishable from the western *aurelia*. Distinction from *M. b. amurensis* Stgr. is also very difficult. The most useful distinctive features are the clear-cut pattern and bright markings on the upper surface. The black discal macules of the fore wing are well developed on both surfaces. The four costal macules of this series usually lie in a straight sequence at right angles to the costa. When this is the case the specimen is probably *centralasiae*, but in some cases the costal macules do not form a regular bar and confusion may occur also with small forms of *ambigua* Ménétr. An examination of the male genitalia is necessary to make a confident determination.

Genitalia. The male genitalia (fig. 74) show a short tegumen with a wide and heavy uncus that is characteristic. In lateral view the posterior process of the clasp (fig. 75) is wide and truncated. The superior border carries a prominent tooth and is prolonged into a sharp process, below which there are several smaller teeth. There is minor variation in the size and arrangement of these teeth. In lateral view the harpe is strong and evenly curved, provided with several teeth. The aedeagus (fig. 76) terminates abruptly in a very small ostium-keel. The large ostium-fold covers a long spiny morula which can be seen plainly through the fold. Except for the highly developed uncus and the unusual aedeagus, the whole structure is very similar to *aurelia* Nick.

Distribution. This insect is recorded from many localities in eastern Siberia, including the eastern Altai Mts., the Sajan, Kentei and Chingan Mts. It appears commonly as a high alpine form, recorded at high altitudes up to 2800 m. I have specimens labelled Troitzkossowsk, and Verity has figured an example from Pokrowka, but these low-lying localities need confirmation and may perhaps indicate simply collection centres. North and east of Lake Baical I have a single specimen from Shigansk and a small, dark arctic form is described below from Sredne Kolymsk. With these exceptions nothing is known of the distribution north and east of Lake Baical and the Amur Valley. The following localities have all been checked by examination of the male genitalia.

Localities.—Kentei Mts.: No further data. Altai Mts.: Only in the eastern Altai—Ongodai 3500 ft. vii.1898. Brit. Mus. (Nat. Hist.). Sajan Mts.: Tunkinsk Weisseberge 2000 m. (ex Staudinger). Chulugaisha 2300 m. (ex Staudinger). Mondy Sajan. Schawyr: Tannuola, 2500 m. Chingan Mts.: No further data. (ex Staudinger). Transbaical: Troitzkossowk



Figs. 74–76.—*Mellicta centralasiae* (Wnukowsky). (74) Male genitalia, dorsal view. Chulugaischa, Sajan Mts., 2800 m. (75) Clasp, lateral view. *a*, Kentei Mts.; *b*, Kentei Mts.; *c*, Chingan Mts.; *d*, Tunkinsk Mts. Sajan. (76) Aedeagus, lateral view.

800 m. (ex Staudinger). Prokowka 1 example, figured by Verity. Arctic Siberia: Shigansk, 1 example, Brit. Mus. (Nat. Hist.); Sredne Kolymsk 8 males in Coll. Nat. Hist. Mus., New York.

M. centralasiae mod. *kolymskya* mod. n.

Male fore wing 12–14 mm. Exp. 25–28 mm.

In this small form melanism is well marked. On the fore wing on the upper surface all

dark markings are heavy and especially the discal macules near the inner margin. On the hind wing the base and disc are dark and only the orange submarginal macules are developed, with indications of the marginal lunules in some specimens. The fringes are strongly chequered with black and white. On the under surface of the fore wing the discal series is variable, strongly marked in three specimens.

The horizontal mark in cellule 1b. is emphasised, the costal bar straight or irregular. On the hind wing in two specimens the pale median fascia does not show the usual black striae and the conspicuous light band recalls *menetriesi*.

Described from a series of 8 male specimens in the collection of the Natural History Museum of New York. The specimens are all labelled Sredne Kolymsk, north-eastern Siberia, Province Yakutsk, 68° Lat., vi–vii. 1903 (*Dr. J. Strojetsky*), A male holotype is specified.

This series is very uniform and the specimens are smaller and darker than those I have seen from other localities. In colour they come nearest to a single specimen from Shigansk on the Lena, also within the Arctic Circle and about 900 miles west of Sredne Kolymsk. I look upon *kolymskya* as an environmental (phenotypical) modification.

Nomenclature.—The nomenclature of this species has presented difficulty and the following notes may be recorded regarding the names that may apply.

(1) *Melitaea aurelia* var. *mongolica* Staudinger, 1892. I have seen the six specimens in Staudinger's original series which are all from the Kentei Mts. One is a small *ambigua*, the other four males, including the lectotype, are certainly *centralasiae*. The butterfly is not recognisable by the external features, and it is fortunate that the original specimens are still extant. Confusion might occur with *amurensis* but I do not believe that this species has been recorded from the Kentei.

(2) *Melitaea aurelia* form *seminigra* Seitz, 1909. This form, described from the Sajan Mts., might be *centralasiae* or *amurensis*. Fortunately the original series is preserved. I have not been able to examine the holotype, but the paratype seen was referable to *amurensis*.

(3) *Melitaea parthenie* var. *orientalis* Ménétr., 1859. Loc. Kamschatka and Amur (Bouri). This name has been applied by Verity to *centralasiae*, but in my opinion there is better reason to retain the commonly accepted application to another insect (see below). Ménétriés explains that a single example had been brought from Bouri (= Kharbarowsk) on the Amur.

MELLICTA MENETRIESI (Caradja) **comb nov.**

Melitaea parthenie var. *orientalis* Ménétriés, 1859, Schrenk's *Reisen* : 23, Pl. 2, fig. 5. Loc. Kamschatka and Amur (Bouri).

Melitaea athalia var. *orientalis* Ménétriés. Alpheraky, 1897, *in* Romanoff, *Mém. Lép.* 9 : 321, Pl. 14, fig. 2a, b. Loc. Kamschatka.

Melitaea parthenie var. *menetriesi* Caradja, 1895, *Dtsch. ent. Z. Iris* 8 : 50. Nom. nov. pro *orientalis* Ménétriés nec *M. orientalis* H.-S., 1843, *Syst. Bearb. Schmett. Eur.* 1 : 265, 266.

Melitaea britomartis race *septentriorientis* Verity, 1930, *Ent. Rec.* 42 : 74. Loc. Kamschatka.

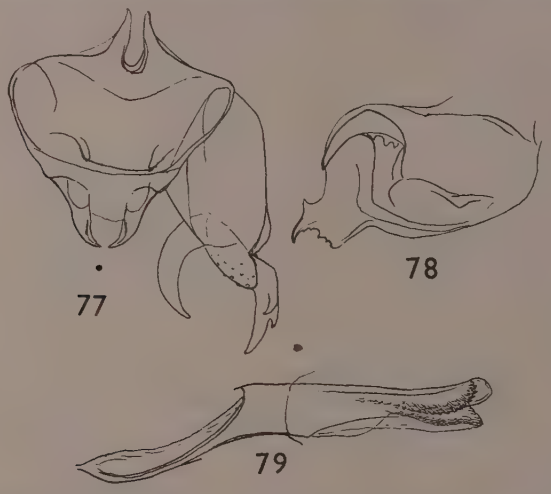
Figs. Alpheraky *loc. cit.* ; Verity 1940, Nos. 124–126, genitalia 311.

The holotype has probably disappeared. Alpheraky (*loc. cit.*) states that he examined the unique specimen described by Ménétriés, which was then to

be found in the collection of the Academy of Science at St. Petersberg. This was in bad condition at the time of his visit, but was exactly similar to many examples brought from Kamschatka by O. Herz, one of which he figured in the *Mémoires*.

Fore wing ♂ 15–17 mm. ; ♀ 17–18 mm.

In the male on the upper surface of the fore wing the marginal lunules are large and pale, the submarginal fascia narrow and often slightly darker, while the post-median fascia is again wide and pale. The median series of black macules is strongly marked and often fused into a heavy fascia, and other black markings are emphasised. The markings of the hind wing are similar, with enlarged and pale marginal lunules, a narrow submarginal orange fascia in a darker tone heavily bordered with black and traces of paler postmedian macules, while the wing-base is entirely suffused with black scales. On the under surface



Figs. 77–79.—*Mellicta menetriesi* (Caradja). (77) Male genitalia, dorsal view (left clasp removed). (78) Clasp, lateral view. (79) Aedeagus, lateral view.

the large size and pale tone of the marginal lunules is a striking feature, and in most specimens the terminal line appears to be single. On the fore wing the enlarged black discal macules appear once more, but behind these the field is clear. On the hind wing the orange submarginal fascia is unusually narrow. The external characters of this butterfly are well-marked, especially the extensive black suffusion at the wing-bases on the upper surface. It is one of the few species in the group that can be identified at a glance.

Genitalia. The male genitalia (fig. 77) resemble those of *centralasiae* very closely. There is a similar broad and heavy uncus and the clasp (fig. 78) shows a posterior process of the same form. In my preparations I think there is a more definite shoulder to the tegumen in *menetriesi*, near the base of the uncal processes and there is also a slight difference in the aedeagus which shows a rounded ostium keel, while in *centralasiae* there is a notch just below the apex. It would be a mistake to emphasise such small differences which may not be constant.

Since the genitalia are so similar it is a matter of opinion whether the two forms are to be treated as sub-species or as distinct species. So far as is known

the habitats are separated by at least 1800 miles. The external features are often misleading in this group, but in this case the facies are so very easily recognised and so constant that I have dealt with the two forms as distinct species.

Identification. *M. menetriesi* is well characterised by the extent of the black shading on the upper surface, and on the under surface by the large white or very pale marginal lunules on both wings, and on the hind wings by the narrow submarginal fascia and the indistinct terminal lines.

The butterfly has been recorded with certainty only from Kamschatka and appears to be the only species of *Mellicta* that occurs there (*see* Nordstrom, 1928). This fact of distribution is of great importance in settling the correct application of Ménétriés' name. It may be that this form spreads further west across the vast tract of hilly country that separates the Kamschatka Peninsula from the Amur, but the record from " Bouri " (= Kharbarowsk) is difficult to explain. The characters of *menetriesi* are so well marked that it is not likely that Ménétriés could confuse the butterfly with another species (*amurensis* or *centralasiae*) when comparing the Amur specimen with two examples from Kamschatka.

Nomenclature. The nomenclature of this form is confused and difficult. In making his description Ménétriés refers to Meyer-Dür's figure of *parthenie*—a pale and lightly marked form—although he does add that the black pattern is thicker in his specimens. He states that the principal distinctive features are on the under surface, where the usual yellow areas are whitish, the pattern of the fore wings less complete and the submarginal fascia of the hind wings narrower, with the macules less rounded at their anterior, i.e. proximal, edge. This written description, although admittedly inadequate, does include some of the features of Alpheraky's insect, especially the reference to the white macules and narrow submarginal fascia on the under surface of the hind wing. It has been customary for nearly a century to identify this insect with the species figured by Alpheraky as *orientalis* Ménétriés and, since two of the original specimens were from Kamschatka, there can be no reasonable doubt that they did represent this species. On the other hand, I agree with Verity that the original figure shows a form much more like *centralasiae* or *amurensis*, with a well-marked double terminal line on the under surface of the hind wing. On this account Verity has proposed applying the name *orientalis* to a form of *amurensis* and suggests a new name *septentriorientis* for Alpheraky's species. Verity's action regarding *orientalis* cannot be accepted as it is impossible to decide whether the figure should be attributed to *amurensis* or to *centralasiae* and, in my view, the matter should be approached from a different angle. Alpheraky has pointed out that Ménétriés' figure is very bad (" *mehr als schlecht* ") and indeed it is scarcely supported by the description, as it fails to show the conspicuous white macules and narrow submarginal fascia on the under surface of the hind wing. In my opinion the indifferent figure may be ignored and Alpheraky's identification made after examination of Ménétriés' specimen should be accepted. Alternatively, if it is considered that Ménétriés possibly confused two different species in his description of *orientalis*, Alpheraky may be looked upon as the first reviser, and he clearly placed the name with the Kamschatka insect, about the identity of which it seems scarcely possible to be mistaken, since no other member of the genus has been reported from the

peninsula. It is unfortunate that *orientalis* cannot stand, so Caradja's most suitable name *menetriesi* is required.

MELLICTA PARTHENOIDES (Keferstein **comb. nov.**

Melitaea parthenoides Keferstein, 1851 (June), *Stettin. ent. Ztg.* **12** : 244. Nom. nov. pro *Argynnis parthenie* Godart, 1819, nec *Papilio parthenie* Bergstr., 1780.

Argynnis parthenie Godart, 1819, *Encycl. Méthod.* **9** : 284. Loc. France : Touey ; Vermanton, etc., Germany.

Melitaea parthenie Godart, 1822. *Hist. Nat. Lép. Fr.* **2** : 75. Loc. France : Chartres ; Auxerre ; Havre. nec *Melitaea parthenie* auct. (= *Papilio parthenie* Borkh., 1788, *nec* Bergstr., 1780 = *Melitaea aurelia* Nickerl).

No subspecies are recognised.

Godart's description of a small double-brooded and light-coloured *Melitaea*, similar to *athalia* and common in France, is sufficient to identify this butterfly. No holotype was specified, but Verity has indicated Godart's localities of Havre, Auxerre and Chartres as topotypical.

Figs. : Oberthür, 1910, *Ét. Lép. comp.* **4** : 347 bis and ter ; Verity 1940, many figures.

Fore wing ♂ 15–18 mm. ; ♀ 16–20 mm. Exp. ♂ 31–37 mm.

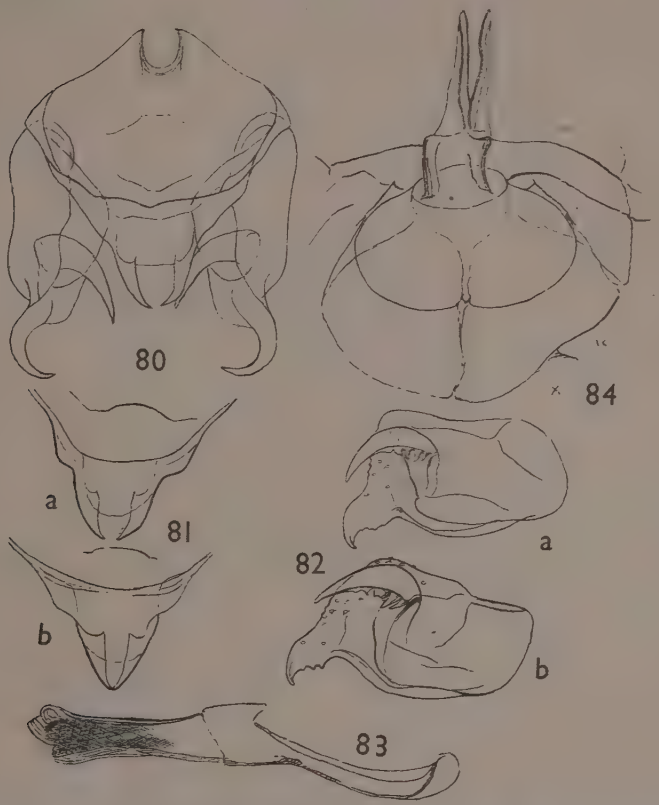
On the upper surface the ground-colour is clear orange in the male with the typical black pattern finely drawn but complete. On the fore wings the black macules of the discal fascia are often emphasised and frequently of an intense black. On the hind wings the post-discal area may be free from black markings, at least in cellules 5, 6 and 7. On the under surface there is little distinctive in the markings of the fore wings. The hind wings show the usual pattern, but the discal fascia is yellowish and not white and the general tone flatter and with less colour than in *athalia*. In the female the upper surface is most variable, but commonly shaded with black scales which give a clouded and greenish colour. As a rule the orange submarginal macules on both wings are slightly darker in tone than the general ground-colour. On the under surface the markings are less complete and less distinct than in the male. This insect may be confused with *athalia*. On the upper surface the clean and regular black pattern with the unmarked discal field of the hind wings will be sufficiently distinct. The females with their dusky wings are easier to distinguish, but much experience is required in many cases to make a confident attribution. *M. deione* Geyer also flies over a large part of the distribution area of *parthenoides*. In most cases *deione* is a larger insect and the characteristic black macules in the discal field of the hind wings, with the slightly different arrangement of marks on the under surface of the hind wings should prevent confusion.

Genitalia. In the male (fig. 80) viewed from above, the tegumen is narrow with a well-developed but rather variable sub-uncus (fig. 81). The clasp (fig. 82) is oval, the basal part of the harpe with well-developed teeth. The posterior process is curved medially and tapers rapidly to a single point, with some small teeth on the inferior border. The aedeagus (fig. 83) has a rather short and blunt ostium-keel, with the morula appearing from the ample folds. The structure shows an approach to *athalia*, but the shape of the clasp is most unusual and unlike that of any other species, so that *parthenoides* must be placed as an isolated form.

The female genitalia (fig. 84) are not distinctive.

Early stages and habits. There does not appear to be a description of the egg. The larva is referred to by several authors, but there is so much confusion with

references to *M. aurelia* Nick. (*parthenie* Borkh.) that I have not been able to trace any description that seems reliable. The butterfly appears in May or June, according to locality and altitude. In mountainous localities it flies up to 5000 ft. or more and there is only a single brood. At lower levels a second brood is usual, which appears in August/September.



Figs. 80–84.—*Mellicta parthenoides* (Keferstein). (80) Male genitalia, dorsal view. (81) Tegumen. *a*, Interlaken, Switzerland ; *b*, Cuenca, Arragon. (82) Clasp, lateral view. *a*, Interlaken ; *b*, Arragon. (83) Aedeagus, lateral view. Espinama, Asturias. (84) Female genitalia, dorsal view. Tiniere, Switzerland.

Variation and distribution (Map 1). *M. parthenoides* is restricted to south-western Europe, with its headquarters in Spain and southern France. It appears throughout Spain and probably also in Portugal, although there is little material from that country. It is a common insect in southern and central France and appears as far north as the departments of Seine-Inferieure and Nord. It enters Germany only in the south-western corner along the Rhine. I have specimens from Baden, and Osthelder reports it from several localities in

Bavaria, e.g. Augsberg, Oberdorf, Kalvarienberg, etc. It is common in western Switzerland in the Rhone Valley, the Jura, Tessin, etc., but does not appear in the north and east. In Italy I know it only from Limone Piemonte in the Ligurian Appenines. The distribution area corresponds closely with that of *M. deione*, but is slightly more extensive. Individual variation is often marked and many bizarre forms have been recorded (*see* Oberthür, 1910, *Lép. comp.* **4** : Pl. 44). Several local races have been named, but I agree with Oberthür (*loc. cit.* **3** : 256) that it is most difficult to define local races or sub-species. At the same time the insect is sensitive to ecological conditions in the usual way. Forms with the brightest ground-colour and with the most delicate black pattern are met with in warm localities, especially in the lowlands, for example in the Midi and on the southern slopes of the Basses Alpes. In the Hautes Pyrénées, where the species flies at alpine levels, many specimens are smaller and the black pattern is more extensive, although normal examples occur in the valleys at the foot of the mountains. Specimens of the second generation, especially those from hot and dry localities, are usually slightly smaller than those of the first brood. Three modifications may be recognised when long series are compared. The average or normal form includes examples from northern France, which are to be taken as typical. Smaller and often slightly darker specimens which appear in mountains at high altitudes may be referred to *plena* Verity. I have long series of this form from the Pyrenees, where the species flies up to 8000 ft., and also from the Asturias Mts. at Pajares and below the Picos de Europa. Some specimens from Brittany also come near to this form, which is never constant and can be recognised only when an adequate series is compared. At the other extreme are large and very bright forms with thin black markings, which appear in some localities. The most suitable name for these appears to be *beata* Caradja, described from Luchon in the Central Pyrenees. Very small bright specimens fly on the Veleta in the Sierra Nevada, which resemble many second-brood specimens from other dry localities. Ribbe has named these *veletaensis*, which may be adopted if a name is required. There can be no doubt that this is *forma tempestatis*, and Querci (Verity, 1940 : 683) has recorded such small examples from near Cuenca in a very dry season, while in a wet year he found large luxuriant specimens in the same locality.

The following forms of *Mellicta parthenoides* Keferstein have been described and named :

albida *Melitaea parthenie albida* Vorbrodt (Wehrli *in litt.*). See p. 95.

austera *Melitaea parthenoides beata* form *austera* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 681. Loc. Barcelona. Named from a single pair, of large size. The male with reddish tone of ground-colour on the upper surface ; the female suffused with grey-green scales.

beata *Melitaea parthenie* var. *beata* Caradja, 1893, *Dtsch. ent. Z., Iris* **6** : 181. Loc. Valleys of the Pyrenees, Luchon, Sost, St. Beat, etc. A large, pale form with average expanse in the male of 39 mm. and female 41 mm. This is the most suitable name to use for the pale, luxuriant forms.

bolivari *Melitaea parthenie* var. *bolivari* de Sagarra, 1930, *Buttl. Inst. Catal. Hist. nat.* (2) **10** : 115. Loc. San Rafael -Segovia (mountain form). The females show marked colour-contrast. A large bright form, perhaps synonymous with *beata* Caradja. Figs. Verity 1940, Nos. 193, 194. The holotype is now in the Museum Cataluna, Barcelona.

cincta *Melitaea parthenie* ab. *cincta* Blachier, 1914. See p. 96.

communis *Melitaea parthenoides* race *communis* Verity, 1931, *Ent. Rec.* **43** : 137. Loc. Angers—Maine-et-Loire. This name falls as synonym to typical *parthenoides*. A name for the first generation from northern France. Figs. Verity, 1940, Nos. 177 ; 178.

completa *Melitaea parthenoides* race *completa* Verity, 1931, *Ent. Rec.* **43** : 136. Loc. Fontainbleau. A name for the second generation of the typical form. Of moderate size with rich colour and well-marked pattern. Figs. Verity 1940, No. 180.

corythalina *Melitaea parthenie* ab. *corythalina* Schawerda, 1929. See p. 97.

elongata *Melitaea parthenie* ab. *elongata* Oberthür, 1910. See p. 97.

escalerai *Melitaea parthenie* ab. *escalerai* Agenjo 1933. See p. 97.

fasciata *Melitaea parthenie fasciata* Vorbrodt, 1912. See p. 98.

gilbon *Melitaea parthenie gilbon* Fruhstorfer, 1916 (1917), *Arch. Naturgesch.* **82** (A) (2) : 12. Loc. Jura. Verity reports that the holotype is referable to *varia* M.-D. See p. 94.

inanis *Melitaea parthenie* race *inanis* Verity, 1921, *Ent. Rec.* **33** : 213. Loc. Pont de l'Arche. A name for small specimens of the second generation of pale colour and fragile build.

jordisi *Melitaea parthenie* ab. *jordisi* Rühl, 1893. See p. 99.

molpadia *Melitaea parthenie* ab. *molpadia* Oberthür, 1910. See p. 100.

nevadensis *Melitaea parthenie* var. *nevadensis* Spuler, 1908, *Schmett. Europ.* 25. Loc. Sierra Nevada ; Aragon. Preoccupied by *deione nevadensis* Oberthür, 1904 (*recte athalia*). See *veletaensis* Ribbe.

ocellata *Melitaea parthenoides* ab. *ocellata* Caruel, 1948. See p. 101.

plena *Melitaea parthenoides* race *plena* Verity, 1921, *Ent. Rec.* **33** : 214. Loc. Gironde (?). The black pattern on the upper surface is thick and the general appearance is darker than normal. Verity says (1940 : 682) that the original locality was given in error as Gironde and that *plena* was taken in the Hautes Pyrénées. This name may be used for dark mountain forms. (*See* p. 90). Pionneau (1928, *P.V. Soc. linn. Bordeaux* **80** : 85–86) says that *inanis* and *plena* are just extreme varietal forms that occur everywhere. Figs. Verity 1940, Nos. 189, 190, 191.

rhoio *Melitaea parthenie* ab. *rhoio* Oberthür, 1910. See p. 102.

semiplena *Melitaea parthenoides* race *semiplena* Verity, 1931, *Ent. Rec.* **43** : 140. Loc. Gedre—Htes. Pyrénées. The black pattern is rather less extensive than in true *plena* Verity. Figs. Verity 1940, Nos. 187, 188.

speyeri *Melitaea parthenie* var. *speyeri* Meyer-Dür, 1851, *Verz. Schmett. Schweiz.* (This book is a reprint from the *Denkschr. Allg. schweiz. Ges.* for the year 1851, published in November of that year.) The name is introduced by Meyer-Dür for an insect described by Speyer in 1848 (*Stettin. Ent. Ztg.* **9** : 138). This was taken near Jena and was referred by him to *parthenie* Ochs. The principal distinctive feature is stated to be the orange-red colour of the palpi. Among the German *Mellicta* this feature is only found in *parthenoides* Keferstein, and, although the locality is rather a long way north, the insect certainly occurs in Wurttemburg and southern Bavaria, and might easily extend up to Jena. On these grounds I think that *speyeri* is correctly placed with *parthenoides* and the name is available for a local form if required. It must be of later date than *parthenoides* (also 1851) since the latter is discussed by Meyer-Dür on the page following the first introduction of *speyeri*.

sphines *Melitaea parthenie sphines* Fruhstorfer, 1917, *Arch. Naturgesch.* **82** (A) (2) : 12. Loc. Geneva, Tramelan, etc. A form of moderate size with fine markings on the upper surface. This form must come very near the typical *parthenoides*.

varioides *Melitaea parthenie* var. *varioides* Rutimeyer. 1942, *Mitt. schweiz. ent. Ges.* **18** : 443. Loc. Eastern Pyrenees—Porte. 1800 m. A small, dark high level form. Probably a synonym of *plena* Verity.

veletaensis *Melitaea parthenie* var. *veletaensis* Ribbe. 1910, *Dtsch. ent. Z., Iris* **23** (Beiheft) : 137. Loc. Sierra Nevada. This name was proposed as nom. nov. pro *nevadensis* Spuler. for the very small. fragile form that flies in the Sierra Nevada, e.g. on Mt. Mulhacen. Resembles the second generation of many localities.

MELLICTA VARIA (Meyer-Dür) comb. nov.

Melitaea parthenie var. *varia* Meyer-Dür, 1851. *Denkschr. Allgem. schweiz. Ges. Naturf.* **12** : 133. Loc. Alps of Graubunden, Switzerland. Fig. 5, 6, Pl. 1.

Note.—The name *varia* was published almost simultaneously by Meyer-Dür and by Herrich-Schaeffer. Meyer-Dür's paper appeared in Vol. **12** of *Denkschr. Allg. schweiz. Ges.* published in November 1851. The first 24 pages of Herrich-Schaeffer's first *Nachtrag* also appeared in 1851 but since I am not aware of the precise date, this must be put at 31st December. (*See* Woodward, *Cat. Lib. B.M.* (*N.H.*) Suppl. : 457). In the absence of evidence to the contrary, the name *varia* should be attributed to Meyer-Dür.

Figs. : Verity 1940, 198–203 ; 338–341.

The type is not known and possibly none was preserved. Meyer-Dür's figures are so good and his record of this as a form of the high alps is so conclusive that the orthodox identification may be accepted without fear of error.

No subspecies are recognised.

Fore wing ♂ 14–16 mm. ; ♀ 14–18 mm. Exp. ♂ 28–32 mm.

On the upper surface in the male the ground-colour is clear orange-yellow. The markings are neat, the black discal macules on the fore wings often enlarged and with a prominent mark in cellule 1b shaped like a sigma lying sideways. The post-discal field is *usually* clear with the terminal black fasciae strongly marked. On the hind wing the base is suffused with black, the discal field clear and the post-discal black markings rather heavy. On the under surface the fore wings often show prominent black macules in the cell and in 1c. On the hind wings the pale basal and discal macules are pure white with the marginal lunules slightly yellowish. The female is slightly larger than the male. The upper surface is dusky with all black markings exaggerated. On the under surface the black marking on the fore wing is less obvious.

There is a good deal of individual variation in the butterfly, mostly depending upon the development or suppression of the black pattern on the upper surface.

Genitalia. The male genitalia (fig. 85) show rather a narrow tegumen, with little character. The clasp (fig. 86) in lateral view is characteristic. The posterior process is strongly curved medially and divided into two large pointed teeth. The aedeagus (fig. 87) is straight, the ostium-keel upturned and almost pointed. There is compact morula and wide folds. This organ is also full of character. The tegumen is rather variable in shape and of simple form, without a definite uncus, although vestiges of uncal points are present in some specimens examined.

The female genitalia are shown in fig. 88.

Early stages and habits. On the southern slopes of the Matterhorn, at the end of June, 1938, I found the mountain swarming with small black Melitaeid larvae. They were feeding upon *Gentiana verna* and, more rarely, upon other gentians. Many pupated quite soon after my arrival. The butterflies began to emerge early in July and all were *M. varia* M.-D. The larvae were about

three-quarters of an inch long, and careful examination showed the following arrangement of spines on segments 3–10.

(1) A dorsal row of white spines with long black hairs between.

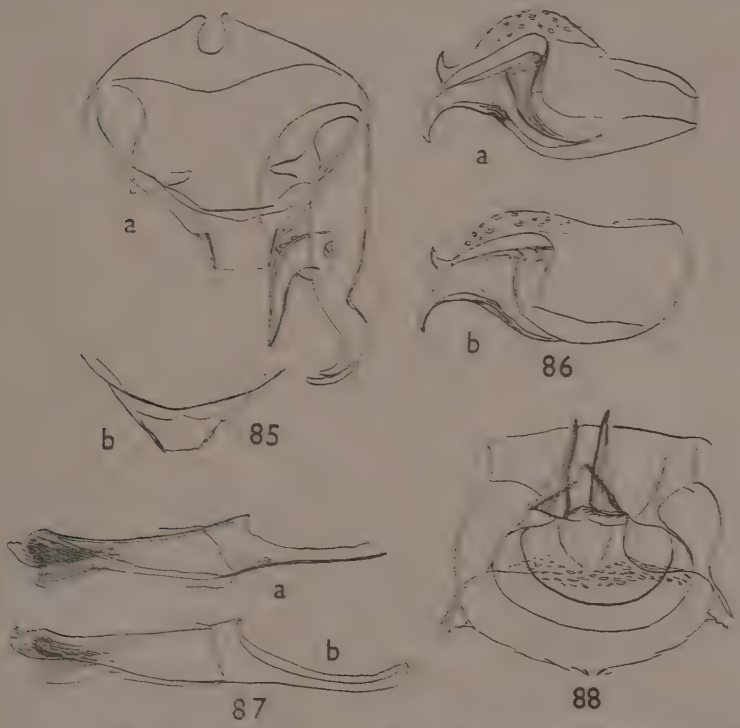
(2) First lateral row, rather large, orange-grey with white tips.

(3) Second lateral row smaller, white.

(4) Third lateral row smaller, orange yellow, but the two most anterior white.

(5) Spiracles.

(6) Small double white spines, lacking on the first, tenth and eleventh segments.



Figs. 85–88.—*Mellicta varia* (Meyer-Dür). (85) *a*, Male genitalia, dorsal view, Limone Piedmont; *b*, Tegumen, Berisal. (86) Clasp, lateral view. *a*, Limone; *b*, Berisal. (87) Aedeagus, lateral view. *a*, Limone; *b*, Sulden. (88) Female genitalia, dorsal view. Pontresina.

All the spines carried fine black hairs. The eyes were orange. There was a fine black line of macules at the base of each row of spines, except between the dorsal and first lateral. The dorsal spines were separated by elongated black warts.

Young larvae were grey rather than black, and all spines were yellowish at the base and paler at the tip.

Distribution and variation (Map 1). The butterfly flies only in the true alpine zone. It is widely distributed and often very abundant throughout the western and southern Alps from 6000 ft.–8000 ft., according to the locality. In the west it does not cross the Rhone valley, and is absent from the Massif Central and from the Pyrenees. Fruhstorfer's record of "Neuveville" on Lake Biel in the Jura cannot be accepted without confirmation. Verity states that he has examined the typical male specimen from the original series of *pathenie gilbon* Fruhst, and finds it is *varia*, but there are no mountains of suitable altitude in the Jura and it is most unlikely that *varia* could occur there. To the east it is recorded by Hellweger from the Oetzthal Alps, and I have it from the Ortler. In Switzerland it is recorded by Vorbrodt from the departments of Genf, Wallis, Sudschwiez and Graubunden. In Italy there is at least one small area south of the valley of the Po where it occurs in abundance, in the Monte Sibillini in the province of the Marches near the Gran Sasso.

The unusual features of the clasp and aedeagus will mark this as an isolated species without any close approach to any other known form. Although there is such wide individual variation in both sexes, there is little evidence of any racial or subspecific development, but a few named forms have been described which are enumerated below :

Localities.—France : Alps of Savoie, Dauphine, Hautes Alpes and Basses Alpes. Generally common at high altitudes. Switzerland : Common on many high mountains in Genf, Wallis, Graubunden and Sudschweiz (Vorbrodt). Austria : Only recorded from the Oetzthal (Hellweger). Italy : The Ortler and other mountains south of Switzerland. Alps of Piedmont. Costa Rotara and Piana Astore in the Monte Sibillini flying at 1400–1600 m. (Verity).

The following forms of *Mellicta varia* have been described and named :

barnumi *Melitaea varia* H.-S. race *barnumi* Dujardin, 1948, *Bull. Soc. ent. Mulhouse* **1948** : 15. Loc. Lac d'Allos (Basses Alpes). A small form, the black pattern heavily dusted with yellowish scales and appearing yellowish-grey.

gilbon *Melitaea parthenie gilbon* Fruhstorfer, 1917, *Arch. Naturgesch.* **82** (A) (2) : 12. Loc. Jura near Neuveville. The male holotype examined by Verity, who identified it as *varia*. I cannot accept this locality without further confirmation. As far as I know it has not been taken again in this area. Described as a large pale form between *parthenoides* and *varia*.

piana *Melitaea varia piana* Higgins, 1930, *Entomologist* **63** : 153 (fig.). Loc. Limone Piemonte in Ligurian Appenines. A large form with wing expanse of 29–33 mm. in males. Taken at a little under 6000 ft. The male holotype, female allotype and 7 ♂ and 2 ♀ paratypes are in my collection.

turiniensis *Melitaea varia* H.-S. race *turiniensis* Dujardin, 1948, *Bull. Soc. ent. Mulhouse* **1948** : 15. Loc. Cime de la Calmette, near Turin. A large and luxuriant race, larger than *piana* Higgins. (Genitalia examined by Dujardin.)

variabella *Melitaea varia* race *variabella* Verity, 1931, *Ent. Rec.* **43** : 152. Loc. Maritime Alps, etc. Type from Clavières in the Cottian Alps. Described as larger and more brilliantly coloured than typical specimens from the Valais and other high mountains of the central Alps.

varissima *Melitaea varia varissima* Verity, 1914, *Boll. Soc. ent. ital.* **45** : 210–212. Loc. Bolognola. Sibillini Mts. Described as showing lighter colouring on both wings. In my series it is difficult to find any constantly different character. In the females there is less dark suffusion on the upper surface, and many are almost like the males.

4. *VARIATION IN MELLICTA*

Aberrations—Polymorphism.

Minor variations, consisting of small deviations from the standard pattern, are very common and it may be difficult to find two specimens in a series with identical wing-pattern. More pronounced abnormality may be divided into two classes. In the first place there are rare cases in which the standard pattern shows striking and unexpected alteration. These aberrations often appear to be entirely fortuitous and isolated and they are, therefore, difficult to classify, although several have now been described and named. In the second place, there are well-known and extreme departures from normal that appear again and again, occurring often in more than one species. Such recurrent aberrations include *aphaea* Hübner, in which the upper surface of both wings shows extreme melanism ; *corythallia* Hübner, in which the hind wings are melanic but with the pattern on the fore wings mostly obliterated ; and *fulla* Quensel, in which the usual black pattern is greatly reduced on the upper surface of both wings. It seems certain that abnormal specimens occur most commonly in certain districts. A tendency to *corythallia* features is obvious in the strictly isolated colony of *athalia* in Kent, England, and Oberthür recorded many abnormal examples among *parthenoides* in certain localities near Rennes. This observation recalls the instability noticed in some colonies of *E. aurinia* Rott. (Ford & Ford, 1930, *Trans. ent. Soc. Lond.* **78** : 345–351). Available specimens of the extreme abnormalities are all from western Europe, but whether such examples are really more rare among Asiatic forms is not known. They do not seem to be common among alpine species. I have not seen either *aphaea* or *corythallia* in the variable *M. varia* M.-D., and the high-level forms of *athalia* appear unusually constant. All examples that I have taken personally have been found at lower levels, several on the Bavarian moors. These departures from the standard pattern that is so constant through the genus appear to me quite remarkable, and must depend upon uncommon genetic combinations which have not been investigated. The appearance of these abnormal forms is characteristic of *Mellicta* and related genera, and appears to some extent also in Argynnids, which suggests the possibility that the active genes existed in the primitive stock before the differentiation of the present species.

List of named forms showing abnormalities of colour, pattern, etc., and of aberrations known to occur in one or more species.

alba *Melitaea athalia* ab. *alba* Rehfous, 1905, *Bull. Soc. lépid. Genève* **1** : 262. Loc. Iselle. The ground-colour on the upper surface is white, the pattern remains black. This form is known to occur in *athalia*, *parthenoides*, *cinxia*, *didyma*. It appears in several species of Argynnidae. Rehfous states that he put forward the name to be used as convenient for all cases of variation of this type in *athalia* and in other species. *M. athalia* ab. *leucophana* Cabeau is probably a synonym of *alba* Rehfous.

albida *Melitaea parthenie* ab. *albida* Wehrli, 1914, *in* Vorbrodt, *Schmett. Schweiz* **2** : 610. Loc. Ochsenfurt. An albino, the ground-colour on the upper surface is white and the usual black markings are grey. I have found only a single record of this form.

aphaea *Papilio* (*nymphalis*) *aphaea* Hübner, 1814–1816, *Samml. europ. Schmett.*, figs. 738–39. No text. A melanic specimen, with the orange submarginal macules well developed on both wings and some indistinct macules in the cells. On the under surface the discal macules of the fore wings are exaggerated.

arcuata *Melitaea aurinia* ab. *arcuata* Caruel, 1944, *Misc. ent.* **41** : 10, Pl. 1, fig. 7. The inner component of the terminal line on the under surface of the hind wing is composed of a series of lunules pointing inwards. Recorded for *Eu. maturna* and *aurinia*. It is not certain whether this aberration occurs in *Mellicta*.

asteriades *Melitaea athalia* var. *asteriades* de Selys, 1857, *Ann. Soc. ent. Belg.* **1** : 19. Name for a very small (dwarf) and dark example of *athalia*. Possibly this should be referred to *aurelia*.

aterrimevittata *Melitaea athalia* form *aterrimevittata* Verity, 1920, *Boll. Lab. Zool. Portici* **14** : 61. Name for two specimens with the black discal fascia of the fore wings greatly exaggerated. An extreme form of *virgata* Tutt. See also *atrovittata* Turati & Verity.

athalioides *Melitaea athalia athalioides* Turati & Verity, 1911, *Boll. Soc. ent. ital.* **42** : 208. Loc. Valdieri, Piedmont. The colour on the upper surface is of a darker tone than usual and approaches *diamina* (*dictynna* Esp.) closely. Said to form a " passage " between the two species.

atro-vittata *Melitaea athalia* form *atro-vittata* Turati & Verity, 1911, *Boll. Soc. ent. ital.* **42** : 209. A form, not rare at Valderi, in which the median fascia of the upper surface of the fore wings is greatly enlarged. Verity (1950) gives as synonyms *fasciata* Vorbrodt, *mirefasciata* Cabeau, *virgata* Tutt, *bifasciata* Rev. Of these names *virgata* Tutt, 1896, should take precedence.

bifasciata *Melitaea athalia* ab. *bifasciata* Reverdin, 1914, *Bull. Soc. lépid. Genève* **3** : 35. Loc. Ile-et-Vilaine, France. A female with a heavy black discal fascia across both wings.

blachieri *Melitaea parthenoides* ab. *blachieri* Caruel, 1946, *Misc. Ent.* **42** : 132. Loc. Jura. A name for the figure in *Bull. Soc. lépid. Genève* **3** : Pl. 2, fig. 4. Nearly albino, with an orange flush only in the submarginal area of the upper surface of the fore wings and the base of the hind wings. See *paleatincta* Verity, 1913.

charlotta *Melitaea aurelia* ab. *charlotta* Rebel, 1912, *Verh. siebenb. Ver. Naturw.* **62** : 4. Loc. Szurduk, Siebenburgen : Fig. 1913, *Verh. zool.-bot. Ges. Wien* **63** : 32. The upper surface is melanic except for the orange submarginal macules. The insect corresponds exactly with *athalia* ab. *aphaea* Hübner. The holotype of *charlotta* is in the British Museum (Natural History).

chappuisi *Melitaea aurelia* ab. *chappuisi* Heinreich, 1916, *Dtsch. ent. Z.* **1916** : 503, Pl. 4, fig. 4. Loc. Berlin. In the post-discal area of the fore wing on the upper surface, the third fascia of black macules is absent and the wide space of orange ground-colour is traversed only by the black nervures. On the hind wings also the black markings are greatly reduced.

cincta *Melitaea parthenie* ab. *cincta* Blachier, 1914, *Bull. Soc. lépid. Genève* **3** : 82, Pl. 2, fig. 12. The under surface of the hind wings shows a wide grey band before the submarginal lunules.

cinnamomea *Melitaea athalia* ab. *cinnamomea* Vorbrodt & Müller-Rutz, 1916 (1917), *Mitt. schweiz. ent. Ges.* **12** : 436. Loc. Maroggia. The outer margin of the under surface of the hind wing is broadly marked with coppery-brown.

cinxio-dictynnoides *Melitaea athalia* form *cinxio-dictynnoides* H. Stauder, 1922, *Ent. Anz.* **2** : 33. Loc. Salzkammergut. The hind wings show a row of white spots resembling *cinxia*. (Possibly referable to *diamina* Lang ?).

commacula *Melitaea* ab. *commacula* Caruel, 1944, *Misc. ent.* **41** : 10, Pl. 1, fig. 9. The lowest of the basal macules on the under surface of the hind wing is confluent with one of the macules of the discal series. Recorded in *aurinia* Rott., *aurelia* Nick. and *athalia* Rott.

corythallia *Papilio corythallia* Hübner, 1790, *Beitr. Geschich. Schmett.* **2** : 51, Pl. 3, fig. 8. On the upper surface the black pattern is nearly obliterated on the disc of the fore wings, but the hind wings are black and only show the orange submarginal macules. Under surface is slightly abnormal. No locality given. In the text the spelling is *corythallia*, and the name is preoccupied by *Papilio corythallia* Esper, 1781 (= *M. phoebe* S. W. V.). It is assumed that the spelling *corythalia* on the plate is a *lapsus calami*. Probably for this reason Hübner figured this form again in the *Sammlung. europ. Schmett.*, fig. 584–588, with the name altered to *pyronia*, 1804.

corythalina *Melitaea aurelia* ab. *corythalina* Rebel, 1913, *Rovart. Lap.* **20** : 82. Loc. Budurasza. The orange macules on the fore wings are greatly extended. On the under surface the hind wings show a wide pale post-discal area, almost unmarked. Corresponds to *athalia* ab. *corythallia* Hb. Fig. 1913, *Verh. zool.-bot. Ges. Wien* **63** : 33. Holotype in British Museum (Natural History).

corythalina *Melitaea parthenie* ab. *corythalina* Schawerda, 1929, *Z. öst. EntVer.* **14** : 105. Loc. Albarracin—Aragon. The black pattern is greatly reduced on the disc of fore and hind wings, approaching *corythallia* Hübner.

csikii *Melitaea athalia* ab. *csikii* Aigner-Abafi, 1906, *Ann. hist.-nat. Mus. hung.* **4** : 496, Pl. 13, fig. 5. No locality given. A melanic aberration with the upper surface of both wings broadly black, traversed by brown venules. On the under surface the macules are extended and fused into streaks. From Coll Ochsenheimer.

cymothoë *Papilio cymothoë* Bertolini, 1829, *Ann. Stor. nat. Bologna* 2 : 237, Pl. 3, figs. 1, 2. Loc. Bologna. This is the melanic aberration with orange submarginal macules the only marking on the upper surface. Equivalent to *navarina* de Selys and described eight years earlier. The form may be associated with *aphaea* Hübner.

deficiens *Melitaea parthenoides* ab. *deficiens* Caruel, 1946, *Misc. ent.* **42** : 132. The black submarginal macules are wanting on the upper surface of both wings. Name for the figure in Oberthür, 1910, *Ét. Lép. comp.* **4** : fig. 340. Loc. Rennes.

demarginata *Melitaea parthenoides* ab. *demarginata* Caruel, 1944, *Misc. ent.* **41** : 10 and fig. 6. On the under surface of the hind wings the black terminal line is single instead of double. Recorded in *athalia* and *parthenoides*.

dorfmeisteri *Melitaea athalia* ab. *dorfmeisteri* Hellweger, 1911, *Jber. Privat. Gymn. Brixen* **34** : 33 (*Grossschmett. Nordtirols*). Loc. Innsbruck. The usual black pattern appears pale grey. On the under surface the macules are coffee-brown instead of black. Hellweger compares this with the form *extincta* Rebel of *A. niobe* L. (Known also in *B. euphrosyne* L.)

elongata *Melitaea parthenie* ab. *elongata* Oberthür, 1910, *Ét. Lép. comp.* **4** : 672, fig. 347. Loc. Aix-les-Bains. Name and fig. only. The fore wings are narrow and elongated. The submarginal and marginal lunules are very heavy. Possibly referable to *athalia*. The holotype is now in the British Museum (Natural History) and shows irregular wing venation.

eos *Papilio eos* Haworth, 1803, *Lep. Brit.* : 35. A typical *pyronia* form, with reduced black pattern on the fore wings and dark hind wings. The name is preoccupied by *Papilio eos* Lang, 1789 (*Apatura ilia* W. V.).

escalerai *Melitaea parthenie* ab. *escalerai* Agenjo, 1934, *Eos, Madr.* **9** : 114. Loc. San Rafael. An extreme *aphaea* form, entirely black above except for the small orange submarginal macules.

evittata *Melitaea athalia* ab. *evittata* nov. Storace. 1943. *Mem. Soc. ent. ital.* **22** : 79. Loc. Italy. An abnormal specimen transitional to *corythallia*.

evittata *Melitaea athalia* form *evittata* Verity. 1916. *Boll. Soc. ent. ital.* **48** : 187. A name for two male specimens in which the discal fascia on the upper surface of the fore wings is scarcely indicated by a few small macules. This form is the reverse of *atrovittata* Turati & Verity and is transitional to *pyronia* Hübner (*secut* Verity).

faivrei *Melitaea parthenie* ab. *faivrei* Le Charles. 1920. *Bull. Soc. ent. Fr.* **1920** : 131. Loc. Fontainbleau. There is extension of the usual black macules and shading on the under surface, transitional to the pattern found in *aphaea* Hübner.

fasciata *Melitaea parthenie* ab. *fasciata* Vorbrodt. 1912. *Schmett. Schweiz.* **1** : 455. Loc. Elgg. A form with a wide deep median band on the fore wings. The most appropriate name for this aberration appears to be *virgata* Tutt. 1896 (*athalia* ab. *virgata*). It is uncommon in *athalia*, but is the most frequent aberration in *deione* and quite common also in *parthenoides*. See *deione* ab. *interligata*.

fennica *Melitaea athalia* ab. *fennica* E. Reuter. 1893. *Acta. Soc. Fauna Flora fenn.* **9** (6) : 14. Loc. Nyland. On the upper surface the black marginal border is wide but the other transverse markings somewhat reduced. The under surface of the hind wings is unicolorous at the base. This is probably an approach to the *corythallia-rhoio* aberration, but there is no figure available and no record of the holotype. It is the first distinctive name for a Finnish specimen. Nyland is the province in southern Finland that contains Helsinki.

flavco-elongata *Melitaea* ab. *flavco-elongata* Caruel. 1944. *Misc. Ent.* **41** : 10. fig. 10. Pl. 1. Loc. Marne. On the under surface one or more of the pale basal macules is confluent with the pale space opposite in the discal series and extended up to the submarginal fascia. Found only in a single example of *athalia*. This sounds very like another expression of *communata* Caruel.

flavescens *Melitaea athalia* forma *flavescens* Matsumura. 1928 (1929). *Ins. Mats.* **3** : 155. Loc. Kyosyo. Northern Korea. A male form described from a single specimen referable to *ambigua*.

fulla *Papilio fulla* Quensel. 1791. *K. svenska VetenskAkad. Handl.* **12** : 280. figs. 7. 8. The figure shows a specimen lacking nearly all markings across the discs of both wings. It is customary to attribute this figure to *cinxia* L., but in my opinion it is more probably referable to *athalia*. This form is probably synonymous with *obsoleta* Tutt. 1896. It is figured by Mosely ! **1** : Pl. 3 *Melitaea*, fig. 5, in a specimen with dark hind wings. It appears to be very uncommon in *Mellicta*.

funesta *Melitaea athalia* form *funesta* H. Stauder. 1922. *Ent. Anz.* **2** : 32. Loc. Linau Tal. Almost unicolorous " smoky "-brown and the orange marks are not clear. There is a single specimen of this form in the British Museum (Natural History), and also an example of *M. aurelia* of the same colour.

fusca *Melitaea parthenoides* ab. *fusca* Delahaye. 1909. *Cat. Lép. Maine et Loire, Suppl.* : 11. There is a reference to Engramelle 7 : Pl. 42. fig. 31*e. f.* The figure shows a melanic upper surface with orange submarginal macules across both wings, the under surface is strongly rayed with black. This name is probably a synonym of *aphaea* Hübner.

grisea *Melitaea parthenoides* ab. *grisea* Caruel. 1946. *Misc. ent.* **42** : 133. Loc. Fort de la Pompelle, France. The upper surface of the fore wings is grey except for a few submarginal orange macules.

hertha *Papilio hertha* Quensel. 1791. *K. svenska VetenskAkad.* Handl. **12** : 280. figs. 9. 10. The figure shows a melanic specimen, but on the fore wings the discal orange fascia is spread widely. This form is illustrated by Frohawk

(1938, Pl. 19) with an example in which the post-discal field of the fore wing is entirely orange.

hisopa *Melitaea athalia* var. *hisopa* de Selys-Longchamps, 1837, *Cat. Lép. Belge* : 19. Loc. Liège, Belgium. The black markings are greatly reduced on the upper durface, the hind wings below almost white. This name is probably a synonym of *fulla* Quens.

illyrica *Melitaea athalia illyrica* H. Stauder, 1914, *Ent. Z.* **28** : 68. Loc. Gorizia. A *pyronia* form, with the markings on the upper surface of the fore wings almost obliterated ; the hind wings nearly black.

indigua *Melitaea athalia* ab. *indigua* Cabeau, 1922, *Rev. Soc. ent. namur.* **22** : 45. Loc. Theux. On the upper surface of the fore wing the submarginal line is wanting, the antemarginal line scarcely marked.

infrafasciata *Melitaea* ab. *infrafasciata* Horhammer, 1935, *Int. ent. Z.* **29** : 397. A name suggested for specimens with exaggerated black discal fascia on the under surface of the hind wings. Reported by the author in *M. phoebe, Eu. aurinia* and *M. parthenie* (i.e. *parthenoides* Kef.) and illustrated in all species.

interligata *Melitaea deione* ab. *interligata* Pionneau, 1932, *Misc. ent.* **40** : 27. Loc. Arles-sur-Tech—Pyrén. Or. The two black macules above the centre of the inner margin of the fore wing are united into a black streak. Compare *Cl. selene* ab. *interligata* Cabeau. It appears that Cabeau is the true author of the name. Pionneau recorded the occurrence of the aberration in *deione*. Recorded also in *parthenoides* by Derenne.

jordisi *Melitaea parthenie* ab. and var. *jordisi* Rühl, 1893, *Soc. ent.* **7** : 164. Loc. Frankfurt a. Main. On the upper surface the black markings are diminished on the fore wings, but the hind wings are black, with a single row of submarginal orange macules. On the under surface the hind wings show a wide pale post-discal field. This corresponds exactly with *corythallia* Hübner. The species is *parthenie* of Borkhausen, i.e. *aurelia* Nickerl. See Caruel, 1944, *Rev. franç. Lépid.* **10** : 77.

jupini *Melitaea parthenoides* ab. *jupini* Caruel, 1944, *Rev. franç. Lépid.* **10** : 75, Pl. 3, fig. 5, 6. Loc. Rheims. On the upper surface of the fore wings the usual black markings are diminished, but the hind wings are broadly dark at the base. This form appears to be transitional to *corythallia* Hübner.

latefascia *Melitaea athalia latefascia* forma nov. Vorbrodt, 1916 (1917). *Mitt. schweiz. ent. Ges.* **12** : 435. No loc. The base and disc of the fore wings up to a yellow macule and narrow marginal band, deep black. Three examples.

lessmani *Melitaea aurelia* form *lessmani* Closs, 1919, *Int. ent. Z.* **13** : 51. Loc. Berlin. On the upper surface of the fore wings the orange submarginal and marginal macules are fused into a continuous band. On the hind wings the orange macules are very small. This form must be very near *hertha* Quensel.

leucippe *Papilio leucippe* Schneider, 1785, *Beschr. europ. Schmett.* : 209. Loc. not recorded. A name for Esper's fig. 2, Pl. 30. This shows the dark female, common in Germany and Austria, with reddish submarginal macules on the hind wings. The name is preoccupied by *P. leucippe* Cramer, 1775.

leucophana *Melitaea athalia* ab. *leucophana* Cabeau, 1912, *Rev. Soc. ent. namur.* **12** : 112. Loc. Virton, Belgium. The ground-colour is pale yellow or white. Recorded also in *cinxia* by Cabeau, 1919.

ligata *Melitaea* ab. *ligata* Caruel, 1944, *Misc. ent.* **41** : 10, Pl. 1, fig. 8. On the under surface of the hind wings the second basal macule (i.e. the third by my counting) is joined with the round discal spot. Recorded in *athalia, aurelia, parthenoides* and *diamina*.

mediofasciata *Melitaea deione* ab. *mediofasciata* Bubacek, 1926, *Verh. zool.-bot. Ges. Wien* **74/75** : 9. Loc. Gèdre, Hautes Pyrénées. The black discal macules are fused into a wide black fascia on both surfaces. There are eight

examples of this form in the British Museum, and it appears to be the predominant aberration in *deione*. See *fasciata* Vorbrodt.

mehadiensis *Melitaea athalia* var. *mehadiensis* Gerhard, 1882, *Berlin ent. Z.* **25** : 126. Loc. The Mehadia, Hungary. Larger than ordinary *athalia* ; on the upper surface of the fore wings the central black macules form a strong fascia which terminates on the inner margin in a long black macule. On the under surface the fascia is also more obvious than usual. Compare *interligata* Cabeau ; *mehadiensis* is described by the author as " var.", but the name has been commonly adopted for large specimens of normal pattern occurring in eastern Europe.

melanalbinotica *Melitaea deione melanalbinotica* Wehrli, 1920, *Mitt. ent. Ver. Basel* **2**, No. 12, with figure. Loc. Stalden. The upper surface is very dark without any clear orange macules. On the under surface the hind wings show a dark basal area with pale discal and marginal fields. This is an extreme *aphaea* form equivalent to *navarina* de Selys.

melanaurelia *Melitaea aurelia* ab. *melanaurelia* Oberthür, 1910, *Ét. Lép. comp.* **4** : 672, fig. 354. Loc. Osnabruck. The figure also shows an extreme form of *aphaea*, with the fore wings almost entirely black on the upper surface. Compare *charlotta* Rebel.

melanodes *Melitaea aurelia* ab. *melanodes* Cabeau, 1910, *Rev. Soc. ent. namur.* **10** : 68. Loc. Lamorteau, Belgium. A melanic specimen with indications of a few orange submarginal macules.

melanoptera *Melitaea aurelia* ab. *melanoptera* Oberthür, 1910, *Ét. Lép. comp.* **4** : 673, fig. 361. Loc. Berlin. Name and figure only. A melanic specimen with a wide post-discal orange fascia on the upper surface of the fore wing. This is very near the typical *hertha* pattern.

mirabilis *Melitaea athalia* form *mirabilis* Fernandez, 1929, *Mem. Soc. esp. Hist. nat.* **15** : 600. Loc. Panalabra, Palencia. A very melanic form, the fore wings are nearly black, but the orange submarginal macules are well developed on the hind wings. On the under surface of the fore wings the black macules enlarge into heavy internervular streaks. This is an extreme *aphaea* form corresponding with *navarina* de Selys. Agenjo (1933) states that the holotype is a female, and attributed by him to *deione* Hübner.

mirefasciata *Melitaea athalia* ab. *mirefasciata* Cabeau, 1923, *Rev. Soc. ent. namur.* **23** : 56. Loc. Belgium. The fore wings on the under surface show a wide and heavy black post-median band.

molpadia *Melitaea parthenie* ab. *molpadia* Oberthür, 1910, *Ét. Lép. comp.* **4** : 671, fig. 337, 338, 339. Loc. Bourg-des-Comptes, Rennes, etc. Name and figure only. Melanic forms showing *hertha* characters, but on the under surface the hind wings are heavily marked. Caruel (1944, *Rev. franç Lépid.* **10** : 79), does not believe there is a place for the name *molpadia*. The form is recorded for *athalia* by Varin, 1933, *Lambillionea* **33** : 6, Pl. 2, fig. 3. This figure is closer to *corythallia* Hübner or *fulla* Quensel.

navarina *Melitaea athalia* ab. *navarina* de Selys-Longchamps, 1837, *Cat. Lép. Belg.* : 19. Loc. Brabant. On the upper surface the wings are black with orange submarginal macules. An extreme *hertha* form, close to *aphaea* Hübner.

nigra *Melitaea parthenie nigra* Aigner-Abafi, 1906, *Ann. hist.-nat. Mus. hung.* **4** : 499, fig. 9. On the upper surface the wings are black with the submarginal macules in orange and a few indistinct macules in the cell of the fore wing. On the under surface the macules are strongly marked and rayed. This appears to be a synonym of *aphaea* Hübner.

nigrathalia *Melitaea athalia* ab. *nigrathalia* Johnstone, 1944, *Entomologist* **77** : 30. Loc. Kent, England. On the upper surface the wings are black with " a few

traces of tawny spots in the centre," i.e. probably in the submarginal area. A synonym of *aphaea* Hübner.

nigrita *Melitaea varia* ab. *nigrita* Aigner-Abafi, 1906, *Ann. hist.-nat. Mus. hung.* **4** : 500, figs. 10, 11. A very melanic form is shown in fig. 10 (Hungary, near Sopro), with a few traces of orange macules in the submarginal area of the hind wings. This is the example to which the description applies and the name should stand for this insect which is *aurelia*. Fig. 11 is described as " another example " from the St. Gothard, and there are slight differences from the first description. This specimen is referable to *varia*. This extreme *aphaea* form has been described many times. See *charlotta* Rebel, *melanaurelia* Oberthür, and under *athalia*.

nigropunctata *Melitaea* ab. *nigropunctata* Caruel, 1944, *Misc. ent.* **41** : 8, Pl. 1, fig. 1. On the under surface of the hind wings the basal macules (1, 2 or more)) are black. The rest of the butterfly is normal. Recorded in *athalia*, *aurelia*, *cinxia*, *phoebe*. Note that Cabeau has named *tramelana* an identical aberration in *aurinia* in which there are four black points.

oberthuri *Melitaea parthenoides* ab. *oberthuri* Caruel, 1944, *Rev. franç. Lépid.* **10** : 78. A name for Oberthür's figures Nos. 336, 346. These are very dark on the upper surface, with scarcely any trace of orange macules. The under surface of the fore wings are strongly rayed with black.

obscura *Melitaea asteria* form *obscura* C. Hosp, 1923, *Int. ent. Z.* **16** : 200. Loc. Chavagl (Piz d'Aela), Engadin. A name for specimens without discal and marginal orange macules.

obsoleta *Melitaea athalia* ab. *obsoleta* Tutt, 1896, *Brit. Butt.* : 305, " failure or partial failure of the dark transverse lines the wings becoming largely fulvous." No locality is given, but we may suppose that Tutt described a British specimen. This name must be a synonym of *fulla* Quensel.

ocellata *Melitaea* ab. *ocellata* Caruel, 1944, *Misc. ent.* **41** : 9, Pl. 1, fig. 4. A black point shows in one or more of the orange macules at the base of the hind wing beneath. Proposed as *M. didyma* ab. *ocellata* Skala, 1907 ; recorded for *Eu. aurinia* by Caruel, 1944, and for *M. parthenoides by* Caruel in 1948. *Misc. ent.* **45** : 66. Loc. Rheims.

paleatincta *Melitaea athalia paleatincta* Verity, 1913, *Boll. Soc. ent. ital.* **45** : 209. Loc. Monte Sibillini. A female form in which the ground-colour of the upper surface is straw-yellow, scarcely accentuated to fulvous in the submarginal area of the hind wings. The pattern is black. See also *blachieri* Caruel.

parnassiotropa *Melitaea athalia parnassiotropa* Bryk, 1923, *Ent. Tidskr.* **44** : 110. Loc. Delsbo. On the fore wings the submarginal fascia is obliterated and the ante-marginal facia is exaggerated.

parthenides *Melitaea parthenides* Verity, 1919, *Ent. Rec.* **31** : 194. A name for specimens of *athalia* or of *varia* in which the black pattern on the under surface of the fore wing is obliterated. Compare *fulla* Quensel.

permixta *Melitaea athalia permixta* H. Stauder, 1922, *Ent. Anz.* **2** : 33. Loc. Lambach. A form showing good colour-contrast on the upper surface, with macules varying from fulvous to yellow. Probably a synonym of *tricolor* Hormuzaki, 1897.

phoibophila *Melitaea deione magna phoibophila* Bryk, 1940, *Ark. Zool.* **32** (A) (22) : 18. Loc. Sierra Nevada. A form with contrasting colours on the upper surface, like *phoebe*. This is probably a synonym of *tricolor* Hormuzaki, 1897.

phyciodina *Melitaea athalia* ab. *phyciodina* Hormuzaki, 1934, *Bul. Fac. Sti. Cernăuti* **8** : 26. Loc. Tetina. This is a melanic form near *aphaea* Hübner, with traces of marginal lunules in addition to the submarginal series.

progressa *Melitaea parthenoides* ab. *progressa* Caruel, 1946, *Misc. ent.* **42** : 136,

Loc. France. The black discal line of the hind wings is strongly marked on the upper surface.

progressiva *Melitaea athalia* ab. *progressiva* Ksienschopolsky, 1912, *Trud. Obshch. Izsl. Volyni* **8** : 38, and figure. I have not been able to check this reference.

punctifera *Melitaea athalia* ab. *punctifera* Verity, 1913, *Boll. Soc. ent. ital.* **45** : 209. Loc. Piceno. The black streak that closes the cell on the upper surface of the hind wings is broken into rounded spots.

pyronia *Papilio pyronia* Hübner, 1804, *Samml. europ. Schmett.*, figs. 585–588. The figures show two examples of the form of *athalia* in which the markings on the upper surface of the fore wings are greatly reduced, although the hind wings remain dark. ***P. eos*** Haworth is a synonym. There is a very beautiful figure of this insect in Stephens, *Ill. Brit. Ent. Haust.* Pl. 4, figs. 1, 2.

pyronioides *Melitaea aurelia* ab. *pyronioides* Reuss, 1921, *Int. ent. Z.* **15** : 5. A form of *aurelia* with markings as in *athalia* ab. *pyronia* Hübner.

radiata *Melitaea aurelia* ab. *radiata* Kiefer, 1918, *Z. öst. Ent Ver.* **3** : 110. Loc. Enntal, Austria. The black basal suffusion on the upper surface extends along the venules to the outer margin and on the hind wings the discal orange macules are scarcely visible. See *sohana* Cabeau, *tectensis* Cabeau, and *M. diamina aduaticana* Cabeau. The name *radiata* Kiefer appears to take priority for all these aberrations except *aduaticana* Cabeau, 1903.

rhoio *Melitaea parthenie* ab. *rhoio* Oberthür, 1910, *Ét. Lép. comp.* **4** : 671, figs. 336, 342, 343, 344, 345, 346. On the upper surface the black pattern is reduced in figs. 343, 344 and 345. In the other figures there is marked melanism. On the under surface in all the figures there is a distinctive aberrant pattern on the hind wings. The orange basal fasciae are present and within these the black markings are exaggerated, as is also the black border. Beyond this the discal area is pale yellow and unmarked, crossed only by the fine black nervures. The orange submarginal fascia is partly developed in most cases. No formal description was published and Caruel (1944, *Rev. franç. Lépid.* **10** : 74) would restrict the name to the paler forms shown in figs. 343, 344 and 345. It seems clear that the name was intended by Oberthür to refer to the abnormal pattern on the under surface of the hind wings, which is the marked feature present in all the specimens figured, and it is with this meaning that I suggest the name should be used. The aberration *rhoio* may appear as a rarity in examples that are almost normal on the upper surface, but in nearly all cases it appears associated with the features of *aphaea* Hübner (= *aphaea-rhoio* Hb.-Ob.) or of *corythallia* Hübner (= *corythallia-rhoio* Hb.-Ob.), examples of which are so well figured by Oberthür.

royoi *Melitaea deione* ab. *royoi* Agenjo, 1934, *Eos, Madr.* **9** : 107 and figure. Loc. Santander. A specimen in which the fore wings are entirely dark except for the orange submarginal macules. The hind wings are normal.

ruhli *Melitaea parthenoides* ab. *ruhli* Caruel, 1944, *Rev. franç. Lépid.* **10** : 77. Loc. Bourg-des-Comptes. A name for Oberthür's figure No. 342. This shows a form near *hertha*, with the fore wings beneath strongly radiated with black.

samonica *Melitaea athalia* var. *samonica* Riesen, 1891, *Stettin. ent. Ztg.* **52** : 357. Loc. Prussia. An aberration with the fore wings almost wholly devoid of black markings. Probably a synonym of *corythallia* Hübner, or very near.

semiradiata *Melitaea athalia semiradiata* Turati & Verity, 1912, *Boll. Soc. ent. ital.* **43** : 232. Loc. S. Anna, 800 m. A female in which the ground-colour on the upper surface is rather dark brown. On the hind wings the brown macules are wide and there is a black streak running from the wing-base to the end

of the cell and enlarged towards the anal margin. This must be near *funesta* Stauder.

sohana *Melitaea athalia* ab. *sohana* Cabeau, 1922, *Rev. Soc. ent. namur.* **22** : 42. Loc. Sohan, Belgium. A melanic form in which the usual orange macules are united to form rays across the discal area of the fore wings. The orange submarginal macules are present on the hind wing, which shows a somewhat distorted pattern beneath. There is close approach to the ab. *tectensis*. Also seen in *aurelia*.

spadana *Melitaea athalia* ab. *spadana* Cabeau, 1922, *Rev. Soc. ent. namur.* **22** : 43. Loc. Spa. There is unusual marking on the under surface of the hind wing. The basal area is fawn, bordered with black and with three or four black points. Beyond is a yellow area with an incomplete post-median band, followed by a wide fawn antemarginal band bordered with black.

stangei *Melitaea aurelia* ab. *stangei* Gillmer, 1905, *Arch. Freund nat. Meckl.* **59** : 71. Loc. not stated. Near *corythallia* Hübner, with orange fore wings showing only a wide median black fascia and a narrow outer marginal streak. The hind wings are black with few traces of orange.

subtus nigrescens *Melitaea* ab. *subtusnigrescens* Caruel, 1944, *Misc. ent.* **41** : 9, Pl. 1, fig. 2. The macules at the base of the hind wings on the under surface are placed in a dark brown field. Met with only in *athalia*.

subtusocellata *Melitaea parthenoides* ab. *subtusocellata* Caruel, 1946, *Misc. ent.* **42** : 136. Loc. Crevin, Switzerland. A name for the specimen figured in *Bull. Soc. Lépid. Genève* **4** : Pl. 6, fig. 6. The pattern on the under surface of the hind wings is abnormal. There is a wide brown basal field beyond which the usual black striae are fused into a discal series of black macules and rings. I have this form also in *athalia*. Compare also *diamina subtusocellata* Rev., 1914, and figure in *Bull. Soc. Lépid. Genève* **3** : 35, Pl. 3, fig. 8.

tectensis. *Melitaea athalia* ab. *tectensis* Cabeau, 1922, *Rev. Soc. ent. namur.* **22** : 41. Loc. Theux. On the upper surface there are a few tawny macules in the cell ; other macules are fused and united into orange rays across the wing. On the under surface the pattern is somewhat distorted, with large black macules at the base of the hind wing. Compare ab. *sohana*, which is very similar, and *M. diamina aduaticana* Cabeau, in which the same pattern appears.

teriolensis *Melitaea athalia* var. *teriolensis* Wagner, 1912, *Verh. zool.-bot. Ges. Wien* **62** : 210. Loc. Tonali Pass. This is an aberration in which the central bands of the fore wings are fused into a wide black fascia. It is not referred to as a race or subspecies by the author. Probably synonymous with *virgata* Tutt, 1896. Wagner adds that the aberration appeared in male specimens and many examples were taken.

tricolor *Melitaea athalia* ab. *tricolor* Hormuzaki, 1897, *Verh. zool.-bot. Ges. Wien* **47** : 30. Loc. Tetina, Roumania. Mentioned also in *loc. cit.* **41** : 233. On the upper surface the central macules of the fore wing are orange-red with pale centres. The basal macules are dark orange ; the post-discal macules pale orange. Cf. *P. leucippe* Schneider.

uncummimans *Melitaea athalia helvetica* ab. *uncummimans* Verity, 1940, *Trans. R. ent. Soc. Lond.* **89** : 612. Loc. Turbigo, Milan. Name for a specimen in which the " uncus " has a slightly unusual shape. Fig. Verity 1940, No. 272.

unifasciata *Melitaea* ab. *unifasciata* Caruel, 1944, *Misc. ent.* **41** : 9, Pl. 2, fig. 5. On the under surface of the hind wings the pale central fascia is not divided by the usual black spots and striae. Recorded by Cabeau for *maturna*, *cinxia*, *phoebe*, *didyma*, *aurelia*, and *athalia*.

virgata *Melitaea athalia* ab. *virgata* Tutt, 1896, *Brit. Butt.* : 305. Loc. Britain. The discal macules on the upper surface of the fore wing are enlarged to form

a prominent black band. Recorded also for *aurelia* Closs, 1919, *Int. ent. Z.* **13** : 51.

Patterns of Variation.

Aberrational variation is so frequent in *Mellicta* and forms such an important feature of the genus that it is worth while making a serious attempt to devise a methodical arrangement of the forms described. The number of these is very large, 93 are recorded here, and at first sight the picture is most confusing. In fact, however, it is clear on closer examination that in almost all cases aberrant examples show one of six types of abnormal pattern for which names may be employed, while unexpected and individual or non-recurrent abnormalities are extremely rare. The principle types of abnormal wing-pattern, properly classed as polymorphic variations, appear again and again, not only in single species but often repeated in several members of the group. and in some cases occurring also in Argynnid species. In such cases it is plainly superfluous and confusing to use a different aberrational name for each. A uniform system was adopted by Courvoisier for the analogous forms met with in the Lycaenini, and in this paper I have followed the example of Caruel, Cabeau and Horhammer (1936, *Ent. Z.* **49** : 465), who have employed the same name for similar alterations in the wing pattern in the Melitaeini. Examples that show fully developed aberrational features are common.

We cannot doubt that these abnormal pattern mosaics are controlled by genetic factors, although unfortunately nothing is known of the genetic constitution of such specimens. No doubt this knowledge will arrive in time and a properly based analysis will be possible. Until then all that can be done is to group the specimens according to the characters shown, and this I have done below. In order to simplify the position it is necessary to refer only to the main features of abnormality which can be attached to a definite name. Small deviations from the common type are to be expected, and in my opinion these do not require a special name, while transitional examples may also be referred to the form to which they tend. A category is required for the variations in ground-colour, albinism, etc., which appear throughout the Argynnid and Melitaeid groups ; in category No. 7 I have placed a number of small irregularities of the normal pattern described by Cabeau, Caruel etc., and which appear closely related. Finally there is a group (No. 8) for the rare non-recurrent variations.

(1) *Melanic Aberrations.*

These form the most important and outstanding group and the normal appearance is so remarkably changed that the forms have attracted attention from very early times. Another interesting feature is the occurrence of such forms here and there over a wide area, in several species and among quite normal specimens. It does not appear that such aberrations are more likely to occur among the dark ecological modifications. In some localities melanic aberrations are not very uncommon and one or two examples may be taken in a single day. In nearly all cases the examples may be placed without difficulty in one of three distinct forms, referred to below as *aphaea* Hübner, *hertha* Quensel and *corythallia* Hübner.

(*a*) ab. *aphaea* Hübner.

This form has been named many times and the principal early synonyms are as follows :

Papilio aphaea Hübner, 1814–1816, *Samml. europ. Schmett.*, fig. 738/39. No text.
Papilio cymothoë Bertolini, 1829, *Ann. Stor. nat. Bologna* 2 : 237, Pl. 3, figs. 1, 2.
Melitaea athalia ab. *navarina* de Selys-Longchamps, 1837, *Cat. Lépid. Belg.* : 19.

All these names refer to examples which show the most extreme melanism. On the upper surface the wings are entirely black with the exception of the orange submarginal macules and sometimes some obscure orange marks in the cell of the fore wings. On the under surface the black marks are often extended and fused to make longitudinal streaks. On the hind wings the black marking may be accentuated but very commonly the orange basal fasciae are followed by a wide unmarked discal field and the submarginal and marginal pattern is reduced or absent (ab. *rhoio* Ob.). Good figures of this aberration are given by the following authors :

Hübner, J., 1790, *Beitr. Geschich. Schmett.* **2**, Pl, 4, fig. W.
Mosley, S. L., 1883, *Illustrations*, Series 1, *Melitaea*, Pl. 3, figs. 1–4.
Frowhawk, F. W., 1938, *Varieties of British Butterflies*, Pl. 5, figs. 1–4.

The aberration has been recorded in *athalia* Rott., *aurelia* Nick. (common), *parthenoides* Keferst., and *deione* Geyer.

The following named forms all represent *aphaea* or transitional examples :

Melitaea aurelia ab. *charlotta* Rebel (synonym).
Melitaea athalia ab. *csikii* Aigner-Abafi (synonym).
Melitaea (*athalia*) *cymothoë* Bertolini (synonym).
Melitaea parthenie (*parthenoides*) *escalerai* Agenjo (synonym).
Melitaea parthenie (*parthenoides*) ab. *faivrei* Le Charles (transitional).
Melitaea parthenoides ab. *fusca* Delahaye (synonym).
Melitaea deione berisali melanalbinotica Wehrli (extreme form).
Melitaea aurelia ab. *melanaurelia* Oberthür (extreme form).
Melitaea aurelia ab. *melanodes* Cabeau (synonym).
Melitaea aurelia ab. *melanoptera* Oberthür (synonym).
Melitaea parthenie (*parthenoides*) ab. *molpadia* Oberthür.
Melitaea athalia form *mirabilis* Fernandez (extreme form).
Melitaea parthenie (*aurelia*) *nigra* Aigner-Abafi (synonym).
Melitaea athalia ab. *nigrathalia* Johnstone (synonym).
Melitaea varia ab. *nigrita* Aigner-Abafi (extreme form).
Melitaea parthenoides ab. *oberthuri* Caruel (extreme form).
Melitaea athalia ab. *phyciodina* Hormuzaki (transitional).
Melitaea deione ab. *royoi* Agenjo (synonym).
Melitaea parthenoides ab. *ruhli* Caruel (synonym).

(*b*) ab. *hertha* Quensel, 1791.

In this melanic form the submarginal orange macules of the fore wings only are expanded to form a wide orange post-discal field. The bases of the fore wings and the hind wings are dark as they are in *aphaea* Hübner. It is obvious that this represents a form intermediate between *aphaea* and *corythallia*

Hübner, described below. I have included it in a special category because it was named and described so early and also because it is a recurrent form. It is represented by fourteen examples in the British Museum (Natural History). The aberration is figured by Quensel and also by the following authors :

Frohawk, F. W., 1938, *Varieties of British Butterflies*, Pl. 19, figs. 1, 2.
Oberthür, C., 1910, *Ét. Lép. comp.* **4,** figs. 342 (unusual features), 361.

The form described by Closs as *M. aurelia lessmanni* is transitional to *hertha*.

(*c*) ab. *corythallia* Hübner, 1790.

Papilio corythalia Hübner, 1790 (*corythallia* in text) *Beitr. Geschich. Schmett.* 2 : 51. Pl. 3, fig. 8.
Papilio pyronia Hübner, 1804, *Samml. europ. Schmett.* fig. 584–588. No text.

There can be little doubt that the name *pyronia* was introduced by Hübner because *corythallia* had been used by Esper in 1780 for *M. phoebe* W. V. Since the name is not used here in a subspecific sense there can be no reason to discard it on this account.

This form is relatively common and very well known. On the upper surface the black pattern of the fore wings is largely suppressed, and the discal area in particular is clear orange. The hind wings are typically dark with the submarginal macules as the only orange markings. On the under surface of the fore wings there may be the usual pattern, or in other cases very little marking. On the hind wings there is usually a pale post-discal area typical of ab. *rhoio* Oberthür, and the close association with *aphaea* Hübner is clear. In some colonies it is not uncommon to find specimens which show transition towards this form, with reduction of the post-discal and submarginal markings of the fore wings. It has been recorded most commonly in *athalia* in its north-western European range, and also in *aurelia* from the same districts and in *parthenoides*.

Figures of this beautiful aberration are to be found as follows :

Stephens, J. F., 1828, *Ill. Brit. Ent. Haust.* 1, Pl. 4, figs. 1, 2.
Freyer, C. F., 1842, *Neue Beitr. Schmett.* Pl. 295, fig. 2.

The following named forms may be placed as *corythallia* or as transitional :

Melitaea parthenie ab. *corythalina* Schawerda (transitional).
Melitaea aurelia ab. *corythalina* Rebel.
Papilio (*Melitaea*) *eos* Haworth (synonym).
Melitaea athalia form *evittata* Verity (transitional).
Melitaea athalia ab. *fennica* Reuter (transitional, but showing *rhoio* on the under surface).
Melitaea athalia illyrica Stauder (synonym).
Melitaea parthenie (*aurelia*) ab. and var. *jordisi* Rühl (synonym).
Melitaea parthenoides ab. *jupini* Caruel (transitional).
Melitaea athalia parnassiotropa Bryk (doubtful transition).
Melitaea athalia var. *samonica* Riesen (probably synonym).
Melitaea aurelia ab. *pyronioides* Reuss (synonym).
Melitaea aurelia ab. *stangei* Gillmer (synonym).

(2) *Aberrations Showing no Tendency to Melanism.*

ab. *fulla* Quensel.

No tendency to melanism appears in this form. On the upper surface the usual black markings are more or less obliterated, while on the under surface the markings of the fore wings are reduced and those on the hind wings greatly simplified in the discal area. Quensel's figure is commonly attributed to *M. cinxia* L., but in this rare form the wing-markings are so abnormal that it is difficult to be sure of the species shown. In *athalia* it has been recorded by Tutt as *obsoleta*, and Oberthür has figured transitional examples which he attributed to *parthenoides* (*rhoio* Ob. *q.v.*). I have not seen any British examples of *fulla* but an illustration is given by S. L. Mosley (1883, *Illustrations, Melitaea*, Pl. 3, figs. 5, 6). Perhaps the distinction from *corythallia* Hübner is rather fine since it depends upon the absence of melanic markings on the hind wings and under surface. I have a male specimen of *varia* M.-D. that shows this abnormality well developed.

The following forms may be placed as *fulla* Quensel :

Melitaea athalia ab. *hisopa* de Selys (synonym).
Melitaea athalia ab. *obsoleta* Tutt (synonym).
Melitaea parthenie (i.e. *parthenoides* Kef.) ab. *rhoio* Oberthür, figs. 343–345 (transitional).
Melitaea athalia ab. *indigua* Cabeau (transitional).

(3) *Aberrations Consisting of Unusual Ground-colour and Change in the Colour of the Pattern from Black to Grey.*

These aberrations are always very rare but they have a special interest as precisely analogous forms occur in some Argynnid species. The following names cover the known range of these aberrations :

Melitaea athalia ab. *alba* Rehfous. The ground-colour is white.
Melitaea parthenie ab. *albida* Wehrli. The normal pattern appears in grey upon a white gound-colour.
Melitaea athalia palaetincta Verity. The ground-colour is pale yellow, slightly fulvous at the wing-margins.
Melitaea athalia ab. *dorfmeisteri* Hellweger. The normal black pattern is grey on the upper surface, dark brown beneath.
Melitaea athalia form *funesta* Stauder. On the upper surface the ground-colour is dark, smoky brown and the markings are not clear.
Melitaea parthenoides blachieri Caruel. A synonym of *alba* Rehfous.

(4) *Aberrations Showing Fusion of the Black Macules into Prominent Bars or Fasciae Across the Wings.*

As a rule this is most marked in the discal and post discal fasciae. Names have been given to many of these forms, which show the same basic anomaly and vary only in degree. While a tendency towards exaggeration of the discal macules is not uncommon, examples with really solid black fasciae across the fore wings are rare. In my view the single name *virgata* Tutt should be sufficient to indicate this aberration.

Melitaea athalia ab. *virgata* Tutt. The discal macules on the upper surface of the fore wing are enlarged to form a wide black fascia. This rare form is not represented in the British Museum. The following names are all applied to indicate a greater or smaller degree of the same aberration, and in my view may be treated as synonyms of *virgata*.

Melitaea athalia form *atro-vittata* Turati & Verity.

Melitaea athalia ab. *bifasciata* Reverdin.

Melitaea parthenie (= *aurelia* Nickerl) *fasciata* Vorbrodt. Recorded also in *athalia* and *parthenoides*. Specimens with a broad black discal band across the fore wings.

Melitaea athalia var. *teriolensis* Wagner.

Melitaea deione ab. *mediofasciata* Bubacek. The abnormality seems to be commoner in *deione* than in *athalia*.

Melitaea athalia var. *mehadiensis* Gerhard.

Melitaea athalia ab. *mirefasciata* Cabeau.

Melitaea deione ab. *interligata* Pionneau. This is a transitional form in which the fusion is restricted to the two macules along the inner margin to make a thick black streak. Probably a synonym of *mehadiensis* Gerh. Recorded also in *parthenoides* Keferst.

aterrimevittata Melitaea athalia form Verity. An extreme form of *virgata*.

(5) *Aberrations in which the Orange Macules on the Upper Surface are Joined into Longitudinal Streaks Across the Fore Wings.*

Melitaea athalia ab. *tectensis* Cabeau. In this form there are some large black macules at the base of the hind wings beneath. As far as I know this specimen is unique. The same aberration is known in *M. diamina* Lang.

Melitaea athalia ab. *sohana* Cabeau. This is another unique specimen very similar to *tectensis* on the upper surface, but there are no black macules at the base of the hind wings beneath. These aberrations should be covered by a single name.

Melitaea aurelia ab. *radiata* Kiefer. This name applies to another specimen which probably may be placed here. This appears to be the most suitable name for forms which show this abnormality of radiating orange streaks on the upper surface. Unfortunately I do not know the whereabouts of the holotype of the specimen described by Kiefer. I have a good example of *aurelia* from Bergun showing this aberration, and another from the same locality in which the discal macules on the fore wings are obliterated.

(6) *Forms Showing Colour-contrast on the Upper Surface.*

Papilio leucippe Schneider (= *athalia*). A name for the dark females, rather melanic on the upper surface, with the submarginal macules on both wings distinctly red, and on the under surface of the hind wing the discal fascia is very white. This female form is not uncommon in the northern and eastern range of *athalia* and can scarcely be called an aberration.

Melitaea athalia permixta H. Stauder. Probably a synonym of *leucippe* Schneider.

Melitaea athalia ab. *tricolor* Hormuzaki. Probably a synonym of *leucippe* Schneider. In this and in *permixta* the sex of the specimen described is not stated. I have not seen colour contrast in *Mellicta* except in the female. It appears commonly in *deione*, *parthenoides* and in *varia*. In *asteria* it is normal. I have not seen *leucippe* forms in Scandinavian *athalia*.

Melitaea deione magna phoibophila Bryk. This is best treated as a synonym of *leucippe*, since it represents the same features in another species.

(7) *Certain Small Variations in the Normal Pattern.*

These variations consist usually of fusion, distortion or exaggeration or obliteration of one or more of the striae or macules on one or other surface, but the abnormality does not produce an obvious alteration of pattern and is perceptible only upon careful examination. (For details see the Appendix.)

Melitaea ab. *arcuata* Caruel.
Melitaea athalia form *cinxio-dictynnoides* H. Stauder.
Melitaea ab. *commacula* Caruel.
Melitaea parthenoides ab. *deficiens* Caruel.
Melitaea parthenoides ab. *demarginata* Caruel.
Melitaea ab. *flaveo-elongata* Caruel.
Melitaea athalia ab. *indigua* Cabeau.
Melitaea ab. *ligata* Caruel.
Melitaea ab. *nigropunctata* Caruel.
Melitaea ab. *ocellata* Caruel.
Melitaea parthenides Verity.
Melitaea parthenoides ab. *progressa* Caruel.
Melitaea athalia ab. *punctifera* Verity.
Melitaea athalia semiradiata Turati & Verity.
Melitaea ab. *subtusnigrescens* Caruel.
Melitaea ab. *unifasciata* Caruel.

(8) *Unclassified Aberrations.*

Most of these are known from unique examples. (For details see the Appendix.)

Melitaea athalia athalioides Turati & Verity.
Melitaea parthenie ab. *cincta* Blachier.
Melitaea athalia ab. *cinnamomea* Vorbrodt.
Melitaea athalia ab. *spadana* Cabeau.
Melitaea parthenoides ab. *subtusocellata* Caruel. Not uncommon.
Melitaea athalia uncummimans Verity.
Melitaea parthenie elongata Oberthür.

5. NOMINA DUBIA.

The difficulties of accurate specific identification in this genus imply corresponding difficulties in nomenclature. Even careful written description may be useless, since in several cases external features show no specific characters. In the cases of names introduced by the older authors, original specimens have usually disappeared, it was not then customary to specify a holotype and the genitalia were not examined. In such cases it seems sensible to accept the conventional determination whenever possible, without too close enquiry. In the case of names published less than a hundred years ago, it seems proper to expect more precision in describing the species and greater care in preserving the original series, with specification of holotypes, and the standard criteria acceptable in the identification of species should be more strictly applied.

Indirect assistance from details of locality, etc., is often helpful and it is surprising how few of these later names remain as problems. In some cases, however, either through loss of the original specimens, failure to make a sufficiently accurate description or for some other reason, I have not found it possible to satisfy myself about the application of a name and such names are included in the following list of *Nomina Dubia*, with notes explaining the difficulty in making a confident specific attribution. In this connection it is as well to point out that specific features are little developed in the female genitalia, and in the case of any new form described, the holotype should be a male. Although under the International Rules a specification of a female holotype is perfectly admissible, it might prove impossible to determine the specific identity of a such a specimen and the description therefore would be valueless for taxonomic purposes.

aceras. *Melitaea athalia* var. *aceras* Hormuzaki, 1911, Z. *wiss. InsectBiol.* **7** : 214. Loc. Bukowina, Roumania.

This is a small form with a wing expanse of 30–34 mm., and in the original description it is compared with *athalia* and *aurelia*. It is said that there are distinctive external characters, the ground-colour less bright than in related forms, and arranged in rather square macules, becoming obscured in the distal area of both wings. It is recorded from few localities, including Cecina, where it appears with *athalia*, var. *mehadiensis*, var. *dictynnoides* and *aurelia*. Figures of the male genitalia show a strong uncus in dorsal view, but in lateral view the clasps do not show any posterior process. The absence of this process in the genus is so remarkable that I think it must be artificial, i.e. the process has been broken away in making the preparations from which the figures are taken. The general shape of the clasps, very wide, suggests that the species may be *britomartis*, which certainly occurs in the Bukowina, but more certain identification is not possible. The description of male genitalia given in the text does not appear helpful.

dictynnoides. *Melitaea aurelia* var. *dictynnoides* Hormuzaki, 1898, *Dtsch. ent. Z. Iris* **11** : 2.

The description concerns a small dark form from the Bukowina. This might refer to *athalia*, *aurelia* or to *britomartis* (*diamina* Lang is rare and extremely local in the region). In a later paper Hormuzaki gives some figures of dissected specimens which he refers now to *athalia* (1911, Z. *wiss. InsectBiol.* **7** : 261–2). In the dorsal view of the male genitalia the presence of an uncus excludes *aurelia*, but I do not feel confident of the attribution to *athalia*. There are four figures of the clasp or posterior process, of which two appear to show *britomartis*. It seems possible that there is a confusion between specific forms, which appears more probable since *athalia* as distinct from *dictynnoides* is also recorded by Hormuzaki from Bukowina. In this case the only way to settle the confusion would be by dissection of the holotype, and there is no indication that this has been done, nor even that a holotype was chosen. Since the name is not important, nor in general use, it seems best to discard it as *nomen dubium*. It is possible that Hormuzaki's original series may still exist, but its whereabouts is not known.

helvetica. *Melitaea athalia* var. *helvetica* Rühl, 1888, *Soc. ent.* **3** : 137. Loc. Stalla and Bergun, Rheatian Alps.

The original description runs as follows :

" Alis vix rotundatis, supra fulvis, fusco-partim reticulatis. Alis posticis fascia media amplificata, lineis distinctis et formans quinque evidenter divisas lineas, de quibus 2 et 3 longiores, quam 1, 4, 5. Alis posticis subtus flavescentibus, fascia media albo-argentea. Haec forma adhuc excelsa est signo praeclaro in cellula secunda radicali alarum posticarum subtus, signum oblongo-quadratum flavum et nigrofasciatum, in ambabus alis aequaliter constructum.

♂ magnitudine Athaliae ♂ ; ♀ paulum major Athaliae ♀.

Habitat in Rhaetica ; volat mens Julio.

♂ mit gestreckten kaum gerundeten Vorder-flügeln, diese selbst der Athalia in Farbe und Zeichnung ähnlich, auf den Hinterflügeln ist aber die breite Mittelbinde streifenartig ausgezogen und bildet 5 deutlich getrennte Längsstreifen, wovon 2 und 3 langer als 1, 4, 5. Auf der Hinterflügelunterseite ist die Mittelbinde silberweiss, ein charakteristisches Merkmal bildet die Form das in der zweiten Wurzelzelle befindlichen Zeichens, ein gelbes Längsquadrat, schwarz gerandet ; das in diesen Form Athalia nicht besitzt. Bei Gelegenheit einer Arbeit ueber das Genus Melitaea bin ich erst darauf aufmerksam geworden, dass dieses Zeichen sehr selten bei Athalia auf beiden Flügeln gleich gestaltet ist ; ganz verschiedene Bildungen desselben kommen beim gleichen Examplare vor. ♀ mit breitem schwarzem Aussenrand aller Flügel, ebenfalls in Farbe und Zeichnung der Athalia ähnlich, von den Streifen der Mittelbinde auf den Hinterflügeln sind aber bei meinen Examplaren nur die ersten beiden deutlich ausgeprägt, die andern in Flecken aufgelöst. Auf der Unterseite der Hinterflügel stimmen die ♀♀ volkommen mit den beschreibenen ♂♂ überein. An Grösse die Athalia ♀♀ überragend messen sie reichlich 20 mm. Flügelspannung. Gefangen ende Juli in Graubündten bei Stalla und bei Bergün. Männchen schon seit einigen Jahren, im heurigen Jahr auch 2 Weibchen, wovon eines ganz tadellos und frisch."

There is no mention of a specification of holotype, and such action was not customary at that time.

A greatly reduced précis of this description appears in 1893, *Die Palearctischen Grossschmetterlinge* **1** : 405. Here it is stated that the discal fascia on the upper surface of the hind wings is spread out into a broad band composed of five clearly separated component stripes.

In order to establish more accurately the precise subspecific features of *athalia* at Bergun and at Stalla (Bivio), I have visited both localities and collected long series of the butterfly at each. Externally the species appears in both places as a small and rather dark form (*alpestris* Vorbt.), as one would expect at high altitudes in this part of Switzerland. Examination of the male genitalia shows a majority of forms intermediate between *celadussa* and *athalia*, though tending rather to the former. In most cases the sub-uncal points are present and in not a few a small sub-uncus is fully formed. The following analysis shows the condition in 23 specimens examined. Since there is no material difference between the specimens from each locality, I have dealt with them together :

Tegumen almost or quite without points . . .	4
Tegumen with sub-uncal points	11
Sub-uncus well developed	8

The intermediate character of the genitalia is confirmed by Monsieur

Bourgogne, who has been good enough to dissect a dozen examples from each locality at my request. By his method of measurement the series give the denominators 6 (Bivio) and 6·5 (Bergun). Since the denominator of *celadussa*, by this method, lies between 0 and 4, the specimens examined fall into an intermediate category, but rather nearer to *celadussa*. Although there are some individuals in my preparations that agree in anatomy with *celadussa* as defined by Fruhstorfer, it does not appear that the forms flying in these districts can be considered representative of the south-western subspecies, and on this account the name *helvetica* is not admissible as a synonym of *celadussa* Fruhstorfer. The genitalia forms correspond closely with a series from Pontresina, where the intermediate characters are well known. If a special name is required for such a series, that of *mixtalpicola* Verity is available.

The name *helvetica* Rühl, already referred to on page 22, presents difficulty from another point of view. It appears first in the literature, apart from Rühl's works, in Staudinger's *Catalogue* of 1901 on page 31 as a " Var.", inserted after *hertha* Quensel. The precise meaning that Staudinger intended to convey by his category of " Var " in this case will never be known. It is used again in a racial or subspecific sense by Fruhstorfer in 1919 (*Arch. Naturgesch.* **83** (A) (3) : 179) without a fresh description, referring to the mountain form of the Engadin (i.e. *alpestris* Vorbrt.). A few years later it was adopted by Rocci, Verity, etc., to replace *celadussa* Fruhst. for the south-western subspecies, on grounds of priority and assuming that the name referred to a form of *celadussa*. This assumption proves to be wrong. It seems possible that many authors have ignored the special features mentioned in the original description, none of which appear in the series taken by me at Stalla (47 examples) nor at Bergün (43 examples). From Rühl's rather careless and inadequate description it is clear that *helvetica* should be a constant or frequently recurrent form, with definite characters referable to both sexes, found in two neighbouring localities, Stalla (Bivio) and Bergün. The size (Flügelspannung) of the female is recorded as 20 mm. in the first description, but this must be an error, as it is too small for any *Mellicta* known from Switzerland. If the measurement should refer to the length of the fore wing, *helvetica* must be placed as one of the larger forms of the species, and no such form is known from this locality. The special features given by Rühl include :

> The fore wings are said to be narrow.
>
> The discal fascia on the upper surface of the hind wing is "like a broad stripe" (*Pal. Grossschmett.* : 406). This is composed of five completely separate macules, of which the second and third are longer than the rest. This must imply light markings on the upper surface of the hind wings and probably, therefore, on the fore wings also. On the under surface of the hind wings the median fascia is silver-white.

A special and characteristic feature, emphasised by Rühl, is the presence " in the second basal cell " on the under surface of the hind wings, of a yellow rectangle outlined with black, a mark said to occur very rarely in *athalia*. I have not been able to interpret this statement.

The Rühl Collection today is preserved in Florence at the Stazione di Entomologia Agraria. It seems that all the original specimens of *helvetica* have disappeared, but I am told by Professor Antonio Melis, the Director of this Institute, that the collection contains a single female example which bears the name label *helvetica* and a locality label, both of which are in Rühl's own

handwriting. The locality of origin is recorded as Samadan, in the Engadin valley and the date of capture is not stated. Dr. Verity would regard this " very small dark female " as the holotype of *helvetica* (1930, *Ent. Rec.* **42** : 131), but this is scarcely possible, since the example did not form part of the original material and comes from a different locality. In my view this specimen throws little light upon the true identity of *helvetica*. Examples of *athalia* from Bivio (Stalla) figured by Verity as *helvetica* (1940 Nos. 71, 72) are similar to those I have collected and do not show the distinctive features recorded by Rühl. Indeed, I cannot believe he would have been tempted to describe them as a new variety of *athalia*, since they are probably indistinguishable from the form that flies in many localities in southern Germany, with which Rühl must have been quite familiar.

It seems to me that it is only possible to attribute *helvetica* to *athalia* if we accept Rühl's bald statement that the description refers to a form of that species, ignoring entirely the special features indicated by Rühl as peculiar to the form. If we seek more precise interpretation it becomes difficult to be sure that Rühl was, in fact, describing any form of *athalia*. The only species that I can think of, that occurs in the district named, with a clear orange median fascia on the upper surface of the hind wing, with silvery-white median fascia on the under surface of the hind wing and with narrow fore wings, is *varia* M.-D. and it is to this species that I believe the name should be referred. The date of capture also, at the end of July, would apply very well to *varia*. Because of Rühl's unfortunate mistake in recording the wing-expanse, his record of size must remain of uncertain value. In view of the difficulty in applying the characters given by Rühl to any form of *athalia* known from the Rhaetian Alps, it is clearly uncertain whether the name can apply to that species, and I have been obliged to place it as *nomen dubium*.

melicerta *Melitaea melicerta* Pfutzner, 1873, *Berl. ent.* Z. **17** : 159. Loc. Breiselanger Forest, Berlin. From the beginning to the end of June.

Many specimens were taken, which indicates a constant form or species. The description indicates a relatively dark insect. On the under surface of the hind wing the double marginal line is filled with brown. In one specimen dark points are present in the submarginal macules. These details do not suggest *athalia*, but more probably *diamina* or *britomartis*, both of which occur with *aurelia* in this district. In the absence of the holotype for dissection I do not feel that it is possible to make use of the name. Fortunately it is not required as a specific name and could apply only to a modification or colour-race. All species of *Melitaea* tend to become dark in the neighbourhood of Berlin.

6. SUPPLEMENTARY NOTES ON THE GENERA MELITAEA AND EUPHYDRYAS.

In the thirteen years that have elapsed since the publication of my Catalogue of the Palearctic *Melitaea* some interesting papers have appeared, chiefly from Mr. E. P. Wiltshire, containing biological and other information, which is now collected together. I have decided to publish these notes as an addendum to the original papers, which are referred to by date and page reference. This

supplement also contains a few names and descriptions accidentally omitted from the previous papers or recently described.

Mr. Francis Hemming has drawn my attention to a long paper by Bryk entitled *Geographische Variabilität von* Melitaea didyma (*Esper*). It appeared in 1940 in *Folia Zoologica et Hydrobiologica*, Volume 10, pages 293 et seq., and contains so many newly-named forms that I have thought it best to include my complete notes (p. 119).

A coloured plate is included in this supplement to show thirteen forms not figured before.

(1) ADDENDA.

1941 : 191. In discussing the Asiatic fauna, Wiltshire has pointed out that only *trivia* is truly a desert insect in Iraq and Iran, and other species of *Melitaea* which appear in the list given on page 191 should be referred to the fauna of "desert mountains," i.e. mountains isolated from one another by desert or steppe-desert. It is certain that *deserticola* Ob. in Africa, and probably *acreina* Stgr., should rank also as desert insects. Wiltshire gives the following list of altitudes for the *Melitaea* species of the Middle East :

(1) Sea-level and upwards to 15,000 ft.	*trivia* W.V.
(2) 5000 ft.	*arduinna* Esper.
(3) 6000–8000 ft.	*persea* Kollar.
(4) 6000 ft.	*sarvistana* Wiltshire.
(5) 7000–9000 ft.	*cinxia* Linnaeus.
(6) 7000–8000 ft.	*gina* Higgins.
(7) 7000–8000 ft.	*phoebe* W.V.
(8) 8000–9000 ft.	*consulis* Wiltshire.
(9) 9000–10,000 ft.	*casta* Kollar.

These records are valid between latitudes 29° and 37° N. The recent discoveries of Wiltshire in Iran were not available in time for inclusion in the distribution maps. Forms now recorded include *Euphudryas aurinia* Rott. in the Elburz at To-Chal, at 11,000 ft., with *M. gina* and *M. casta* also on this mountain group. There is no doubt that *sibina* Alpheraky has been taken in the country, but the locality cannot be traced. Including *M. alraschid* Higgins, of which I know of only one specimen, at least 14 species of *Melitaea* are known to occur in Iran, which appears with Turkestan as the principal centre of the group.

1941 : 210. The figures of the genitalia of *M. didyma mixta* Evans were all taken from examples of the form *problematica* Sheljuzhko. Examples of the much rarer typical form were not available until the figures were drawn, and the genitalia showed no material difference.

1941 : 220. *M. didyma orinomus* Rutimeyer, 1942, *Mitt. schweiz. ent. Ges.* **18** : 435. Loc. Porte, Eastern Pyrenees. A large mountain race taken at 5200 ft. (1700 m.). The males are fiery red, and dark shading appears on the upper surface in most females. The description suggests an undistinguished *meridionalis* form and this is confirmed by specimens in the writer's collection from this locality.

M. didyma praemarsilia Verity is said to be " the late emergence of the first brood of *subtarlonia* Verity." However it is compared chiefly with *marsilia* Fruhstorfer.

M. didyma praxilla Fruhstorfer : Gaede, 1930, *in* Seitz. *Suppl.* **1** : 120, Pl. 13, fig. E.40. Loc. Herzegowina and Bulgaria. This name was not published by Fruhstorfer and evidently has been introduced by accident. It was used by Fruhstorfer for a race of *diamina* Lang and as applied to *didyma* it is invalid. The form may be sunk in *dalmatina* Stgr.

1941 : 236. *M. abyssinica scotti* Higgins. The reference to *M. didyma* subsp. by G. Warneke (1933, *Mitt. munch. ent. Ges.* **23** : 31) may be referred to this species. Loc. Makalla, Hadramaut, Arabia.

1941 : 237. *Melitaea casta* Kollar. Further exploration has established the existence of at least two well-marked colour-forms of this species, one in the north and the other in the south near Shiraz. These are now described and compared as follows :

(1) *M. casta casta* Kollar. Plates I and II, fig. 9 ♂; 5 ♀.

The ground-colour on the upper surface is sandy-yellow. In the male on the fore wings there are indications of marks in the cell and the oblique orbicular mark can be seen. The discal macules are small. In one specimen they form a complete series, in another only four macules are present to make a costal bar. There are no markings in the post-discal area. The marginal lunules are united to form an irregular and almost continuous line on the fore wing. The hind wing shows a small black basal suffusion, but otherwise it is unmarked. There is black marginal line to both wings in which the internervural dots are visible. On the under surface the markings on the fore wings are faintly indicated. On the hind wing the ground-colour is dull yellow with a sandy flush. There are indications of the usual markings, but with so little colour-contrast that the orange fasciae are almost obsolete and the exact pattern is difficult to describe. I have not seen a female of this form.

Localities.—Kuh-Kalat near Shiraz, vii, at 8500–10,000 ft. ; Kuh-Deeshk, 9000–10,000 ft. (*E. P. Wiltshire.*)

Wiltshire considers that this form represents typical *casta* Kollar and claims that his specimens are topotypes. Several features confirm this application of the name. Each character described by Kollar is perfectly suitable and in particular the words " *quod fasciae in alarum posticarum pagina inferiore fere evanitae sunt.*" This passage can only refer to Wiltshire's *casta* among all the numerous *Melitaea* now known to occur in the mountains around Shiraz.

(2) *M. casta wiltshirei* Higgins. Plates I and II, fig. 11 ♂.

This form has been described (1941 : 237), but a short comparison may be given here.

The ground-colour on the upper surface is bright tawny-orange with the black marking more intense in tone. The marginal lunules form a complete and regular series along the margins of both wings. On the under surface on the hind wings the orange macules and fasciae are well-defined and bordered with the usual black spots and lunules.

Locality.—Mt. Alvand near Hamadan 7500–9000 ft., 27.vii.

Wiltshire made several notes about *casta* which were circulated privately in typescript in 1940, 1941 and 1942, but not published until 1945, *Ent. Rec.* **57** : 78. The butterfly was found by Brandt and again by Wiltshire at Barm-y-Feruz, in the Province of Ardekan, at an altitude of 11,000–12,000 ft. These

specimens are close to the northern form, with complete submarginal lunules on the upper surface, but the ground-colour is decidedly lighter than it is in the typical *wiltshirei*. I include figures of both sexes from this locality. Until recently Kollar's holotype was reputed to exist in the National Collection at Vienna, but I cannot say whether it is to be found there today.

1941 : 245. *M. pseudoala* Sheljuzhko. There are two males in the collection of Lt. Col. F. M. Bailey, collected by him in the Pskem valley, near Tashkent. This locality is new, but scarcely extends the known range of the species. The determination has been checked by examination of the genitalia. Other species from this collection should be recorded as follows :

M. pallas Stgr., Togoruckschibu, Pamirs, 24.vii.1928 ; Pskem Valley, Turkestan, 11.vii.1919. Small and dark specimens taken at 9000 ft.

M. minerva balbina Tytler, Ishpadog, Chitral. 5.vii.1928.

M. trivia W. V., form near *robertsi* Butler, Quetta, Baluchistan.

M. trivia tigris Higgins, Madaglasht, Chitral, 15.iv, 9500 ft.

M. fergana Staudinger, Pskem Valley, Turkestan, 11.vii, 10,000 ft.

M. sibina Alph., Pskem Valley, 10.vii, 4500 ft.

1941 : 223. *M. transcaucasica* Turati. This form was figured and described but not named, by Lederer in 1864, *Wien. ent. Mschr.* **8** : 166 and Pl. 3, figs. 3, 4. The specimens were taken by Haberhauer at Abbastuman in the south-eastern Caucasus. It seems most probable that this insect " represents " normal *didyma* in this region, and it would be logical to consider *transcaucasica* a subspecies of *didyma* if this is the case.

1941 : 277. For information regarding the early stages of *arduinna* see Wiltshire, 1952, *Bull. Soc. Fouad Ier Ent.* **36** : 175. The food-plant at Shiraz is *Centaurea behen* L., with which the larvae and butterfly are associated in that locality. So many larvae are destroyed by Apantelid parasites that it did not prove possible to breed a single example through to the imago.

1941 : 351 I do not think that it is possible to maintain a specific distinction between *M. turkmanica* and *M. consulis*. The principal difference in external characters appears on the under surface of the hind wings, where the markings are complete in *turkmanica*, while in *consulis* the markings are indistinct. The slight difference in the male genitalia, if constant, suggests a sub-specific feature, possibly associated with isolation of colonies over a long period. No more specimens of *turkmanica* have been discovered.

1941 : 263. *M. trivia* W. V. Lieut.-Col. H. O. Piele, I.M.S., tells me that he has caught this insect on the North-West Frontier of India flying about with the temperature at 120° F. in the shade. The rocks in the sun were far too hot to touch, yet the butterflies appeared to be quite at home in such conditions.

A most interesting comment has been sent by Wiltshire—I quote from his letter :

" I cannot agree that *trivia* is usually extremely localised. I have found it in the Middle East the most euryoecus of all *Melitaea* and indeed it is the only one able to breed in true steppe or desert, as opposed to mountains in the desert zone. Its food-plants, *Verbascum* and *Scrophularia*, are so generally distributed that it occurs almost everywhere except in mud-desert, and if the record from Baghdad is correct, it occurs even there. It is found from sea-level up to the topmost peaks."

In discussing the local variation of *trivia* in Persia, Wiltshire states that in the south, in Fars Province, all generations are consistently darker and come nearer to the European form. The first brood is the largest. Fars is relatively moist and specimens from the drier parts of the country are attributable to the paler *robertsi*.

1941 : 299. *M. arcesia* Bremer. The reference to *Bull. Acad. Sci. St. Pétersb.* **3** : —*Add* page reference " 466."

M. baicalensis Bremer, *read* " *baikalensis* " and *add* reference " 1861, *Bull. Acad. Sci. St. Pétersb.* **3** : 465." Mr. Hemming suggests that the name *baikalensis* should be used in place of *arcesia* since it has page priority in two publications. It has also been used in the literature (cf. Graeser, 1888, *Berl. ent. Z.* **32** : 88). I prefer to retain *arcesia*, since a change would lead to confusion in nomenclature and also the figure of *baikalensis* is drawn from an aberrant specimen and cannot be identified with certainty.

1941 : 307. *Add* : *Melitaea sindura gaimana* Sugitani, 1937 : *Zephyrus* **7** (1) : 2, Pl. 1, fig. 3 ♂ (holotype) ; 9 ♀ (allotype). Loc. Korea. The text is in Japanese. The figures show a well-marked and not particularly dark form, without special characters, which might be placed with typical *arcesia*. The species has not been reported before from Korea and its occurrence there is most interesting.

1941 : 309. *M. arcesia irma* Higgins, Pl. 1, fig. 6, paratype ♂. The male holotype is now in the British Museum (Natural History), from W. Nepal. The female allotype is in the author's collection from Chungsa, S.W. Thibet, 14.viii.1936.

1941 : 310. *M. arcesia balbita* Moore. Wiltshire reports that he took the insect in 1942 (1943, *Ent. Rec.* **55** : 97). Owing to excessive grazing the species is becoming very local and it has disappeared altogether from the Goorais plain. He found it flying on swampy ground at the foot of slopes in the Kishenganga Valley, from 7400–9000 ft. altitude.

1941 : 322. *Add M. diamina composita* Verity, 1935, *Ent. Rec.* **47** (Suppl.) : 71. Loc. Between Vernayaz and Martigny, Switzerland. On the under surface the brown bands of the hind wings are not bright chestnut but chocolate-brown, and in some specimens quite pale. This may be an approach towards *alpestris* Fruhst. The name was accidentally omitted from the Catalogue.

1941 : 338. After *M. phoebe punica* Ob. *insert* : *Melitaea sarvistana* Wiltshire, Pl. 1, fig. 17. This fine species was described and figured by Wiltshire in 1941, *J. Bombay nat. Hist. Soc.* **42** : 473, Pl. fig. 3 ♂ (not ♀ as stated). Loc. Sarvistan, S.E. of the Shiraz salt lake, Iran. Wiltshire gives a wing-expanse of 45 mm., but my specimen measures only 40 mm. A line drawing of the male genitalia is given in 1946, *Ent. Rec.* **58** : Pl. 1 (5). The following description is abridged :

> On the upper surface the colouring resembles *P. egea* Fabricius. The black submarginal lunules are complete in both wings. Other markings are very faint and on the fore wings the discal series is nearly obsolete. On the under surface of the hind wing the black markings are emphasised.

The specimen now figured was kindly given to the writer by E. P. Wiltshire. A single imperfect specimen has been found in the British Museum (Natural History).

1941 : 339. *Add* : *M. phoebe allophylus* Rutimeyer, 1942, *Mitt. schweiz.*

ent. Ges. **18** : 438. Loc. Porte, Eastern Pyrenees. A large, brightly coloured form leading to *occitanica* Stgr. It is difficult from the description to define any real individual characters for this race and my topotypical specimens are well placed as *corythallia* Esper.

1941 : 340. *M. phoebe* ab. *fasciata* Wiltshire, 1946. *Ent. Rec.* **58** : 26. Loc. Shiraz in southern Iran. The discal spots are enlarged and united into a fascia. Figured on Pl. 3, fig. D (April, 1946). The name is preoccupied by *phoebe fasciata* Galvagni, 1934.

1941 : 341. *Add* : *M. phoebe nigrogyia* Verity, 1939. *Ent. Rec.* **51** (Suppl.) : 17. Loc. St. Dionisio, Macedonia at 800 m., gen. 2. The fore wings are short and rounded with pale dull colours, resembling *telona* Fruhstorfer.

Add : *M. phoebe parva* Gerhard, 1882. *Berl. ent. Z.* **26** : 126. Loc. Hungary. Described from small examples of the second generation. The name *parva* Caradja falls as a homonym.

Add : *M. phoebe postogyia* Verity, 1939. *Ent. Rec.* **51** (Suppl.) : 16. Loc. Salonica. Described from very small specimens of the second generation. The fore wing sometimes measure only 15 mm. See also *pauper* Verity and *parva* Gerhard and Caradja.

1941 : 345. *Melitaea aetheria* Hübner. *Add* as synonym : *M. aetheria* Duponchel *in* Godart & Duponchel, *Hist. Nat. Lep. Fr., Suppl.* **1** (*Diurnes*) : 278, Pl. 44. Loc. Russie Méridionale (?).

1941 : 351. *Melitaea consulis* Wiltshire. The butterfly is described and figured in 1941, *J. Bombay nat. Hist. Soc.* **42** : 473 (figs. 1, 2) and also in 1946, *Ent. Rec.* **58** : 26, Pl. 7, fig. B. The male holotype and female allotype are in Wiltshire's collection. Both were taken at 8000-9000 ft. on 3.v.1940, on a mountain near Shiraz. The specimen figured on Pl. 16 is a male paratype kindly given to the writer.

M. consulis ab. *proconsulis* Wiltshire, 1946, *Ent. Rec.* **58** : 26, Pl. 7, fig. A. In this aberration the submarginal lunules on the upper surface are heavily emphasised. Loc. Shiraz 8000 ft., 23.v.1941.

1941 : 353. *Melitaea gina* Higgins. In a short note in 1946, *Ent. Rec., loc. cit.*, this species is recorded also from the Elburz Mts., taken there by Brandt and Wiltshire. It was also taken by Brandt above Sineh-Safid. There is a figure by Lt.-Col. H. D. Pelle, I.M.S., in 1922, *J. Bombay nat. Hist. Soc.* **28** : 345, fig. 17 of the plate, of a male specimen with reduced black markings, an example of a second or third generation. The locality is given as " Harir, Aug. 1918, 1 male and 1 female." Wiltshire gives a line drawing of female genitalia. This shows a very tall cone such as I have not seen in *didyma*. Paratypes are shown in Pls. I and II, fig. 8 ♂ : 3 ♀. Holotype, Brit. Mus. (Nat. Hist.) No. 15997.

1950 : 443. *Euphydryas iduna inexpectata* Shelj. Pl. I, II, fig. 1. It has been possible to give figures of this form through the kindness of Herr Pfeiffer, who has lent paratypes from his collection. It is clear that I was mistaken in considering this with typical *iduna*. In my opinion, after seeing these specimens, it will be more correct to place *inexpectata* as a subspecies. Further material of *iduna* has been seen through the help of the Natural History Museum, New York. Dr. Klots has sent for my inspection a series of fresh specimens from Sredne Kolymsk in north-eastern Siberia. These appear to correspond

perfectly with typical examples from Norway. It will be strange if this species does not exist in arctic America.

1950 : 448. *Euphydryas intermedia wolfensbergeri* was recorded from France by Favre in 1899 (St. Martin, Lantosque ; Alpes Maritimes). It has lately been found again and is recorded by de Lesse from several localities in Savoie : Peisey (Mont Poirri), St. Hugon (Massif d' Alevard), all localities situated within the area of the river Isère. (1951, *Rev. franç. Lépid.* **13** : 143–152.

1950 : 466. *Euphydryas aurinia siberica* mod. *tjutjuensis*. The male holotype is shown on Pl. I, II, fig. 2. Attention may be called to the heavy dark markings and unusual facies which suggests a " wet " form. A good series of this form is to be found in the British Museum (Natural History) in the collection at Tring.

1950 : 467. The complicated systematic arrangement of the *aurinia-debilis* series needs further explanation. The complex is divisible into low-level and high-level forms. The low-level forms include the subspecies *aurinia* of central continental distribution, *siberica* in the eastern refuge area of the Amur valley, and in the south-west *beckeri* most probably should be placed also as a subspecies. The high-level forms include *debilis* in the European alps and *banghaasi* in the Kentei, Altai and Sajan Mts. In all cases the high-level forms are associated with low-level *aurinia* in the same districts, but the insects inhabit different levels of vegetation and biologically are quite distinct. The external distinctive features are vague and in the cabinet in some cases the high-level and low-level forms are not separable, and the genitalia seem to be identical. While *aurinia*, *siberica* and *beckeri* form an obvious group of subspecies, it is a matter of opinion whether *debilis* and *bang-haasi* should be placed as additional subspecies with *aurinia*, or separated as a high level species or treated as two distinct species. I prefer to retain *debilis* and *bang-haasi* as subspecies within the *aurinia* specific group.

(2) Analysis and Comments on the Paper by F. Bryk (1940) on Forms of *M. didyma* and Allied Species.

F. Bryk, 1940. Geographische Variabilität von *Melitaea didyma* (Esper). *Folia Zool. Hydrobiol.* Riga **10**: 293.

M. didyma tschecha (subsp. n.). Bryk, *loc. cit.* : 301, Pl. 1 fig. 3 ♀ (type), 6 ♂. Loc. Wopparntal, Bohemia. The male is bright foxy-red, the black markings well developed and the females suffused. This appears to be a form without any definite characters that distinguish it from the nominotypical Bavarian race.

M. didyma austria (subsp. n.). Bryk, *loc. cit* : 302, Pl. 1 fig. 9 ♂ : Pl. 2 fig. 11 ♀ (type). Loc. Gieshubel, Austria. In the figure the black macules on the upper surface of the male are well developed, and the female is strongly suffused. It is described from a single pair. I can find no characters that distinguish this from the nominotypical race.

M. didyma magnalpina (subsp. n.). Bryk, *loc. cit.* : 304, Pl. 2 fig. 13 ♀ (type) Soc. Innbsruck. Very much like *alpina* Stgr. from the Egadin, but slightly larger.

M. didyma niesiolowskii (subsp. n.). Bryk, *loc. cit.* : 305, Pl. fig. 8 ♀ (type of *cinereoradiata* forma nov.). Pl. 3 fig. 27 ♂ (type of *nigrovenata* forma nov.) : fig. 28 ♀. Loc. Kiwierce, Volhynia. This is a dark form, the black markings

on the upper surface of the male are very heavy and the females strongly suffused. There is no figure of the type of *niesiolowskii*, which appears to me to correspond with *crasnensis* Hormuzaki. Form *nigrovenata* is an aberrational name applied to the single male figured, in which the nervures on the under surface of the hind wings are black between the two orange fasciae. Form *cinereo-radiata* is an aberrational name applied to a single female figured with bright reddish ground-colour on the upper surface between the disc and the outer-margin of the fore wings and along the anterior margin of the hind wings. The post-discal markings of the fore wings are produced into streaks.

M. didyma gravosana (subsp. n.). Bryk, *loc. cit.* : 307, Pl. 3 fig. 22 ♀ ; 26 ♂ (type). Loc. Gravosa. A small form with *occidentalis* characters, transitional to or identical with *dalmatina* Stgr.

M. didyma embriki (subsp. n.). Bryk, *loc. cit.* : 311. Not figured. Loc. Ponte, Ticino. A brilliant *meridionalis* form with the black markings in the male slightly reduced. Perhaps this should be referred to *praemarsilia* Verity. Type ♀ (25 mm.) v.1922.

M. didyma irridens (subsp. n.). Bryk, *loc. cit.* : 312, Pl. 3 fig. 20 ♂ (type) ; fig. 21 ♀ ; Pl. 6 fig. 58 ♀. Loc. Campodazzo, S. Tirol. In the male the black pattern is well developed. In the female the upper surface is suffused, but on the fore wings the ground-colour is yellowish distally. This is a *meridionalis* form transitional to *alpina*, described from a single pair.

M. didyma uralicola (subsp. n.). Bryk, *loc. cit.* : 314, Pl. 4 fig. 31 ♀ (type). Loc. Uralsk. This is said to be close to *neera*, but distinguished by the narrower wings. Some females are heavily suffused. Except for the suffusion on the upper surface of the female type there seems to be little to differentiate this from *neera* F. de W.

M. didyma crimitaea (subsp. n.). Bryk, *loc. cit.* : 315, Pl. 2 fig 19 ♀ (type). Loc. Kertsch. The male on the upper surface is rosy-orange, the female paler orange varied with yellow. Described from one male and two females. This is an *occidentalis* form transitional to *neera* and near *elevar* Fruhst.

M. didyma kirgisica (subsp. n.). Bryk, *loc. cit.* : 315 (*note*). No figure. Loc. Kirgis Steppes. Said to be near *uralicola*, but differs in the absence of colour-contrast on the upper surface, and the lighter black markings. Described from a single female. Probably a synonym of *neera* F. de W.

M. didyma caucasicola Sheljuzhko. Bryk, *loc. cit.* : 316, Pl. 1 fig. 2 ♂ ; Pl. 2 fig. 12 ♀ ; Pl. 6 fig. 55 ♀. Loc. Caucasus. I cannot trace the publication of this name by Sheljuzhko. It is invalid, as it is a homonym of *M. phoebe caucasicola* Verity, 1919. The specimens figured by Bryk show a male of *didyma* close to *neera*, and a female of *persea caucasica* Stgr. The male figured may be specified as holotype and the form will then fall as a synonym to *neera* F. de W.

M. didyma maledescripta (subsp. n.). Bryk, *loc. cit.* : 318. A name suggested for the specimens figured as *caucasicola* Shelj. if in fact they are not truly referable to that form. This name will also fall as a synonym to *neera* F. de W.

M. didyma pontifex (subsp. n.). Bryk, *loc. cit.* : 321, Pl. 4 fig. 30 ♀ (type). Loc. Amasia. In the male the post-discal macules are usually wanting. The females are more or less suffused and tend to the form *cinerea* Higgins. This is a *meridionalis* form probably synonymous with *variabilis* Belter.

M. didyma pfeifferi (subsp. n.). Bryk, *loc. cit.*: 322, Pl. 5 fig. 42 ♂ (type). Loc. Marasch Taurus 600–900 m. Described from two males, but the date of emergence is not stated. It is a small form transitional to *dalmatina* and probably synonymous with *variabilis* Belter.

M. didyma schwingerschussi (subsp. n.). Bryk, *loc. cit.* : 323, Pl. 5 fig. 46 ♂ (type). Loc. Bscharre, Lebanon. The male is bright orange-red, the discal marks on the hind wings developed. Described from a single specimen of the first generation. This name may be treated as a synonym of *libanotica* Belter, 1934. A single male specimen of the second generation is also described, in which the ground-colour is paler and the black markings are reduced. This is named *belteri* in a footnote (p. 324), where it is referred to *deserticola* Ob.

M. didyma warnekei (subsp. n.). Bryk, *loc. cit.* : 324, Pl. 5 fig. 45 ♂ (type). Loc. Arabia Petrea. The ground-colour on the upper surface is pale yellow and the markings are much reduced. On the under surface of the hind wings the orange fasciae are wide and bordered with well-developed black lunules. It is described from a single specimen taken in 1835, of which the body is missing. This is said to be a male, but I think this may be an error. The under surface is not figured and I am not able to place the form with certainty. Probably it should be referred to *deserticola* Ob., a desert form near *macromaculata* Belter.

M. didyma occidentalis Stgr. forma **draconimorpha** (forma nov.). Bryk, *loc. cit.* : 326 (not figured). On the under surface the posterior orange macule at the base of the hind wing is absent. The form is said to be near *interrupta* Skala. This aberrational form is described from a single male from Spain.

M. didyma africa-felix (subsp. n.). Bryk, *loc. cit.* : 326, Pl. 1 fig. 5 ♂ (type). Loc. Sebdou, Algeria. This is a small *occidentalis* form. The name can be treated as a synonym of *mauretanica* Ob.

M. didyma magnacasta Verity. This is figured on Pl. 4 fig. 32 ♀, showing a female *trivia* W. V.

M. didyma geminella (subsp. n.). Bryk, *loc. cit.* : 332, Pl. 4 fig. 33 ♂ (type) 34 ♀. Loc. Kuldscha. This is a form of medium size, the discal markings in the male rather heavy. The female show little dark suffusion. The specimens are transitional from *neera* to *turkestanica* Sheljuzhko.

M. didyma sutschanala (subsp. n.). Bryk, *loc. cit.* : 335, Pl. 3 fig. 29 ♂ (type) ; Pl. 6 fig. 51 ♂. Loc. Sotka Gora, Siberia. Bryk says that he has not seen specimens of typical *sutschana* Stgr. The form now named appears to me to represent a typical specimen of this species. It is described from a single male.

M. didyma mandschukoana (subsp. n.). Bryk, *loc. cit.*: Pl. 4 fig. 35 ♀ (allotype) Loc. Kintschou, S.–W. Manchuria. The example is of medium size, with a wide marginal border on the hind-wings. The description of the male and the female figured represent typical *didymoides latonia* Groum. The specimens were taken in September and probably represent a second generation.

M. didyma kansicola (subsp. n.). Bryk, *loc. cit.* : 338, Pl. 2 fig. 14 ♀ (type). Loc. Lanchowfu, Kansu. The specimen figured is referable to *didymoides latonia* Groum. This form, described from a single female, is also referred to as *kansuensis* Bang-Haas *in litt.* The figure suggests a " dry " form, with rather scanty markings.

M. didyma hummeli (subsp. n.). Bryk, *loc. cit.* : 338, Pl. 2 fig. 15 ♀ (type). Loc. Hutjertu-Gol, S. Mongolia. The figure shows a form of *didymoides*

approaching *latonia* Groum. It is described from the single female figured. Associated with this insect is a pair from the Tabo-Gol, which are smaller and probably even nearer typical *didymoides*.

M. didyma transbaicalia (subsp. n.). Bryk, *loc. cit.* : 341, Pl. 4 fig. 38 ♀ (type). Loc. Noworotnaja, Schilka River. Pl. 6 fig. 53 ♀ (underside). The figure shows a typical specimen of *sutschana* Stgr. The form is described from this single specimen.

M. didyma walteri (subsp. n.). Bryk, *loc. cit.* : 343, Pl. 1 fig. 10*a* ♀ (type). Loc. Changai Mts. The figure shows a typical specimen of *didymoides didymoides* Eversm. The form is described from the single specimen figured. It is well-known that this species is common in the Changai Mts.

M. didyma mongoligena (subsp. n.). Bryk. *loc. cit.* : 342, Pl. 4 fig. 36 ♂ ; 37 ♀ (type) ; Pl. 6 fig. 56 ♂ (underside). Loc. N. Mongolia in lat. 100–120° long. 45–50°. The figures show specimens of *latonigena* Eversm. which come very close to *altaica* Groum.

M. didyma distinctissima (subsp. n.). Bryk, *loc. cit.* : 345, Pl. 3 fig. 25 ♀ (type). Loc. Caucasus. The figure shows a specimen of *transcaucasica* Turati. The form is described and named from a single pair.

M. ala allah (subsp. n.). Bryk, *loc. cit.* : 346, Pl. 3 fig. 23 ♂ (type) : 24 ♀ : Pl. 6 fig. 57 ♂ (underside). Loc. Siberia. This form is described from two males and one female. Both surfaces of the male holotype are figured, but the insect does not appear to be correctly placed with *ala*. The male figure suggests an example of *transcaucasica* Turati. The female figure is referable to *ala* Stgr. It should be placed probably with *bicolor* Seitz. Fig. 57 shows a male and not a female as stated.

M. ala sheljuzhkoi (subsp. n.). Bryk, *loc. cit.* : 348, Pl. 5 fig. 48 ♀ (not fig. 49 as in the reference). Loc. Kuldscha. In the male the black macules are said to be better developed than in *bicolor* Seitz. On the under surface of the hind wings the nervures are said to be less distinctly outlined with black. The female figured may be specified as holotype. In my opinion it is not separable from the form *bicolor* Seitz.

M. ala determinata (subsp. n.). Bryk, *loc. cit.* : 349, Pl. 5 fig. 39 ♂ : 40 ♀ (type). Loc. Fu-Shu-Shi, Thian Shan. Taken by Sven Hedin at 2100 m. In the male, on the upper surface, the ground-colour is intense foxy-red, the black pattern heavy and bright. The female is large and without markings on the disc of the hind wings. Unfortunately the figures are poor. This form corresponds with specimens from the Amdo figured on Pl. 6 figs. 5 and 11 of the 1941 *Catalogue*. It represents a modification which seems to be common in the eastern Thian-Shan, with characters somewhat intermediate between the typical form and *bicolor* Seitz. The name *determinata* Bryk will be useful to apply to this form, which appears to be a constant development. It is worthy of comment that of the 32 new names introduced by Bryk in this paper, this is the only one that has any possible value.

M. ala strandi (susp. n.). Bryk, *loc. cit.* : 350, Pl. 5 fig. 44 ♂ ; 47 ♀ (type). Loc. Urumtschi, Nan-Shan. 2500 m., vii. The figure of the male is probably not correctly placed with *ala*, and appears rather to represent a heavily marked form near *didymina* Stgr. The female figured is probably true *ala*, very close to *bicolor* Seitz. The occurrence of this species in the Nan-Shan is unexpected and requires confirmation. Since in this group the female genitalia

do not show well-marked specific characters, the application of the name to a form of *ala* must remain unsatisfactory, since it will rest with an opinion based upon the variable external characters, and is not capable of precise confirmation.

M. ala ella-claudia (subsp. n.). Bryk, *loc. cit.* : 531, Pl. 5 fig. 49 ♂ ; 50 ♀ (type) ; Pl. 6 fig. 54 ♂ (allotype). Loc. Aulie Ata, Talas Ala-Tau, Kasakstan. The figures show typical *pseudoala* Sheldj. and the name must fall as a synonym for this species. Identification should be confirmed by examination of the male genitalia.

7. SYSTEMATIC REVIEW OF THE PALAEARCTIC MELITAEINI.

So many interesting features appear during the consideration of the systematics of these butterflies that a general review of the whole series is worth while, although this will involve some repetition. The points to be discussed fall easily under the headings Generic, Specific and Infraspecific.

(1) Generic.

The genera *Euphydryas* and *Mellicta* are most compact and homogeneous in all respects. Each presents definite features and stable species without any intermediate forms connecting with other generic groups. In *Melitaea* the position is quite otherwise. This large group is not homogeneous. The species fall naturally into three groups (Higgins 1941 : 192) for which I have taken *didyma* (29 species) *cinxia* (6 species) and *phoebe* (7 species) as typical species. More recently Verity (1950 : 89) has suggested the introduction of generic names for these groups. If such names are accepted, it is well to remember that each group is connected with others by intermediate forms flying in central Asia, although the European representatives appear quite distinct. The position of the European species is therefore isolated and does not allow consideration in proper perspective with related forms. On this account I prefer to retain for these assemblies the vague term " group," since the term genus implies in my mind a compact group, distinctly limited and separated by some clearly recognisable features from other related species. On the other hand, elimination of a few localised and atypical species (e.g. *butko*, *romanovi*, *arduinna* and *collina*) would be sufficient to isolate the *didyma* group. The other two groups, represented by *phoebe*, *cinxia* and *diamina* with their related forms, appear so closely allied that a satisfactory generic restriction in this series would be much more difficult.

(2) Specific.

The Palearctic region may be divided into two distinct and contrasting areas in which the specific development of the Melitaeini follows completely different patterns. The northern area is largely identified with the decidual forest zone and " Taiga," extending across the entire Eurasiatic continent. The preponderant genera are *Euphydryas* and *Mellicta*. The number of species is not large, while isolated and atypical forms have not yet been described. An important feature is the dispersal throughout the region of a few species with very wide distribution. Specific variation appears in two principal forms. In the first place there is marked graded variation (cline formation), which

appears to depend upon environmental factors. This appears in all species with extensive distributions, and is fully described on p. 13. In the second place there is condensation into subspecific groups. This appears in a strictly methodical manner, when specific distribution passes from one faunistic area into another, and in relatively few species. Of the grand total of nineteen species that inhabit this great area, only seven present subspecific differentiation and, in addition, there is a single polytypic species with two localised forms. These species, with the localities of subspecific differentiation, are as follows :

M. didyma.—4 Subspecies : Central (*didyma*), Angara (*latonigena*), Pamir (*mixta*), ? Caucasus (*transcaucasica*).

M. diamina.—2 Subspecies : Central (*diamina*), Angara (*protomedia*).

M. phoebe.—3 Subspecies : Central (*phoebe*), Angara (*scotosia*), N. Africa (*punica*).

M. aurelia.—3 Subspecies : Central (*aurelia*), Caucasian (*albimaculata*), Thian Shan (*distans*).

M. athalia.—4 Subspecies : Central (*athalia*), Iberian (*celadussa*), Arctic (*norvegica*), Angara (*ambigua*).

M. deione.—2 or 3 Subspecies : Iberian (*deione*), N. Africa (*nitida*). (*deione berisalii* of the Valais might be included, but perhaps it is better placed as a microsubspecies).

E. aurinia.— 3 or 4 Subspecies : Central (*aurinia*), Angara (*davidi*), Alpine (*glaciegenita* and *bang-haasi*).

Polytypic species.—*E. desfontainii* Ibero-African. *E. orientalis* Asia-Minor.

In addition, there are four forms that may possibly rank as incompletely differentiated subspecies :

M. didyma mauretanica Ob. : Ibero-African.

E. aurinia beckeri Led. : Ibero-African.

M. diamina wheeleri Chapm. : Southern watershed of the Alps of Europe.

M. athalia nevadensis Ob. : Sierra Nevada.

These four butterflies provide the only instances throughout the group in which it appears to the writer that subspecific differentiation may be actively in progress. Considering the vast geographical dispersal of the forms, the great differences in environment and the close segregation of most colonies, it seems remarkable that there is so little evidence in this region of active subspeciation. All further variation is either frank polymorphism or else conforms with recurrent, graded series that must be placed as clines. This confirms the observation of Mayr (1942 : 97) that areas showing marked clinal (graded and continuous phenotypical) variation show little tendency towards active specific differentiation.

Another interesting feature appears in the subspecific distribution areas which correspond in so many species. The conditions prevailing along the zones of intergradation are known only in the case of *athalia*, in which the boundary zones in the west (*athalia-celadussa*) and in the north (*athalia-norvegica*) have been carefully investigated. These show, in the first case, intergradation of the subspecific characters (genitalia) in a steep cline, and in the second case a similar cline marked by the appearance of unusual external characters (*lachares* Fruhst.). The pattern of racial segregation that appears in all these species is suggestive of subspecies formed during geographical isolation, with secondary intergradation after the disappearance of the geographical barrier.

The climatic changes that occurred during the Pleistocene Glacial Periods at once suggest themselves as the most likely cause of such a picture. In the case of the African subspecies the discontinuity, of course, persists.

The southern region of Central Asia includes the Middle East with Persia, and the mountainous districts of Samarcand, Turkestan, the Pamirs, the Himalayas, Tibet and Szechuan. The state of affairs in this great region is completely different. Here there are extremes of climatic conditions which vary from tropical deserts to the world's highest mountains. There are no species with an extensive distribution that could correspond with such forms as *athalia* and *aurinia* in the northern zone. The specific distribution consists of a large number of relatively isolated forms and *Melitaea* is the only genus represented.

I have referred above to the division in this genus into three (or perhaps four) principal groups (p. 125) more or less connected by intermediate forms, a state of things that has no parallel in the northern region. In spite of the wide variety in ecological conditions, there is little tendency, except in the western areas, towards continuous graded variation or cline formation, but there is a much greater production of species and highly developed subspecies. These distinctions occur between forms flying in neighbouring districts, and without any obvious connection with faunistic areas. Some explanation of these facts will appear in the isolation of small racial groups upon individual mountain systems, which may imply complete and long-standing isolation, although the distances involved may not be great. These conditions have given rise to the remarkable " formenkreisen " which are so characteristic of this fauna. The most striking of these is associated with the species *M. arcesia*, probably an Angara form that has spread throughout the mountains of Szechuan, Amdo and the Himalaya as far west as the Indus valley. At least eight distinct forms are to be included within the species complex, some still connected by intermediates, others apparently completely distinct. Further west in the Karakoram, Pamirs and mountains of Samarcand there appears the formenkreis of *M. minerva*, of which five distinct forms are easily recognisable. These insects fly in little-known countries and it is scarcely possible to speak so confidently about their distribution, but it seems probable that a distinct form will be found to occupy each considerable mountain group. Probably the same explanation will account for the survival of atypical forms, often extremely localised, which bear all the features of relict forms.

A short analysis of the *Melitaea* of Central Asia may be given to show systematic features :

(*a*) Localised and monotypic species : *montium*, *acreina*, *didymina*, *lunulata*, *ambrisia*, *infernalis*, *shandura*, *athene*, *yuenty*, *gina*, *avinovi*, *pallas*, *collina*, *sarvistana*. Total 14 species.

(*b*) Species showing graduated phenotypical variation (clines), some probably also with subspecific differentiation, but material not adequate for proper evaluation : *persea*, *casta*, *ala*, *chitralensis*, *trivia*, *arduinna*, *agar*, *sibina*. Total 8 species.

(*c*) Species showing definite subspecific differentiation : *saxitilis* (2), *desertícola* (2), *abyssinica* (2), *arcesia* (8), *fergana* (2), *lutko* (2), *romanovi* (2 ?), *minerva* (5), *turanica* (3), *turkmanica* (2). Total 10. [Number of subspecies inserted in brackets.]

Special reference must be made to the species *athalia*, *didyma*, *phoebe*,

diamina, *cinxia* and *aurinia*, that form such a large proportion of the individuals of the Melitaeid fauna of the northern regions. In each case these represent the single member of a large specific group that has developed a constitution sufficiently plastic to enable the unit to make a wide transcontinental dispersal. Possibly another species, *M. britomartis*, should be added to this number. Of these forms that appear so well equipped, only *athalia* and *aurinia* represent the characteristic northern genera of *Mellicta* and *Euphydryas* respectively. The relatives of the species *didyma*, *phoebe*, *diamina* and *cinxia* are all to be found in the Central Asiatic fauna. These butterflies must be regarded as wandering species, endowed with constitutions adaptable to varying climatic environments, which have been able on this account to escape from their original birthplace in Central Asia, where all their relatives remain.[1] The position of the European forms is thus isolated and unlike that of most European butterflies. *M. diamina* and *M. phoebe* are among the few species that fly from Spain across the whole continent to the Pacific coast. *M. didyma* is certainly represented in the Amur basin, but it is uncertain whether it reaches the eastern coast, while *M. cinxia* scarcely enters the Angara fauna.

(3) Infra-specific categories.

Variation of this order, that has already been dealt with at some length, falls under the two headings of polymorphism (aberrations) or environmental (phenotypical) modification. It is scarcely too much to say that all species that live at low or moderate altitudes, with a reasonably extensive distribution, will show superficial changes that clearly depend upon environment, and the point that still needs some discussion is the method of handling such variation in the systematics of the group. Such racial or local differences are often marked: are such races to be treated as subspecies, as microsubspecies or as enviromental modifications (ecophenotypes)? In most cases I have taken the view that such colour forms are dependent upon the basic physiology of the organism and as such they should not be brought into the nomenclature. This treatment is suggested when similar forms in various species are noticed to appear in similar environment in widely different localities (parallel variation). In other species, with more restricted distribution, similar changes may be noticed of minor degree, and these, too, may be judged analogous with the more extreme cases. Once the possibilities of variation of this type are realised it is natural to feel extremely cautious in allotting subspecific rank to any given form unless good material is available to show the ecological variation throughout the species distribution. It is indeed doubtful whether such variation, which can be analysed as a system of clines, can ever be regarded as promoting a specific or subspecific change (Mayr, 1942, *loc. cit.*). It seems to me that it is possible to distinguish between such environmental forms and microsubspecies. I associate the latter class with a form which has developed characters that do not fall within the normal pattern of recognisable clines, but which appear only in a small area.

In the Melitaeini, so often strictly localised into small colonies, it might be supposed that microsubspecies would be common. This is not so, and, apart

[1] This statement requires some modification, since two species of the *didyma* group—*didymoides* and *sutschana*—appear in the Amur basin.

from ecological variation, the species are curiously constant. The only forms known to me that might properly be considered as microsubspecies are as follows :

E. aurinia aurinia form *comacina*. Loc. Monte Generoso.
M. deione berisalii. Loc. Near the Tour de la Batiaz in the Valais.
M. athalia nevadensis Ob. Loc. Mulhacen Mt., Sierra Nevada.

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PLATES I AND II.

FIG. 1.—*Euphydryas iduna inexpectata* Sheljuzhko. ♂ paratype. Teberda, Caucasus, 2700 m. Coll. Pfeiffer.

FIG. 2.—*Euphydryas aurinia tjutjujensis* Higgins. ♂ holotype. Tjutjuje, Sichota Alin Ussuri. Coll. Higgins.

FIG. 3.—*Melitaea gina* Higgins ♀. Kuh Deeshk, Fars, Iran. 30th May, 1941. 8/10,000 ft. Coll. Wiltshire.

FIG. 4.—*Melitaea casta* Kollar trans. ad *wiltshirei* Higgins ♀. Barm-i-Firuz. 29th June, 1941. 11,000 ft. Coll. Wiltshire.

FIG. 5.—*Melitaea casta* Kollar ♀. Shiraz Mts., Iran. 9000 ft. 2nd June, 1950. Coll. Wiltshire.

FIG. 6.—*Melitaea arcesia irma* Higgins. ♂ paratype. Barangse, W. Nepal. 29th July, 1936.

FIG. 7.—*Mellicta plotina* (?) Bremer ♀. "Sidemi," Manchuria. *ex* B.M. (N.H.).

FIG. 8.—*Melitaea gina* Higgins ♂. Sineh Safid, Fars, Iran. 19th May, 1950. 7/8000 ft. Coll. Wiltshire.

FIG. 9.—*Melitaea casta* Kollar. ♂ topotype. Shiraz, Iran. 12th May, 1940. 8000 ft. Coll. Wiltshire.

FIG. 10.—*Melitaea casta* Kollar trans. ad *wiltshirei* Higgins. ♂. Barmi-i-Firuz, S.W. Iran. 9th July, 1950. 11,000 ft. Coll. Wiltshire.

FIG. 11.—*Melitaea casta* Kollar *wiltshirei* Higgins. ♂ paratype. Mt. Alvand, Iran. 27th July, 1938. 9000 ft. Coll. Higgins.

FIG. 12.—*Mellicta athalia* mod. *reticulata* mod. n. holotype. "Altai cent. Mont." No further data. Coll. Higgins.

FIG. 13.—*Mellicta aurelia distans* subsp. n. ♂ holotype. Tekkes, 4500 ft. 30th May, 1930. Coll. Higgins.

FIG. 14.—*Mellicta rebeli* Wnukowsky. ♂ paratype. Tchuja Mts., S.E. Altai. 12th July, 1890. 6500 ft. H. J. Elwes leg. Coll. B.M. (N.H.).

FIG. 15.—*Mellicta rebeli* Wnukowsky. ♀ allotype (?). Tunkinsk Weissgeb, Irkustk. 2000 m. July. *ex* Staudinger. Coll. Higgins.

FIG. 16.—*Mellicta athalia anatolica* Wagner ♂. Sultan Dagh. July, 1934. Coll. B.M. (N.H.).

FIG. 17.—*Melitaea sarvistana* Wiltshire. ♂ topotype. Sarvistan, S.W. Iran. 1st May, 1950. E. P. Wiltshire leg. Coll. Higgins.

FIG. 18.—*Melitaea aurelia albimacula* Nies. ♂ paratype. Bilagi-don, 1800 m. Centr. Caucasus. Coll. B.M. (N.H.).

FIG. 19.—*Melitaea athalia* mod. *satyra* mod. n. ♂ holotype. Karlovo, Bulgaria. July, 1953. Coll. Higgins.

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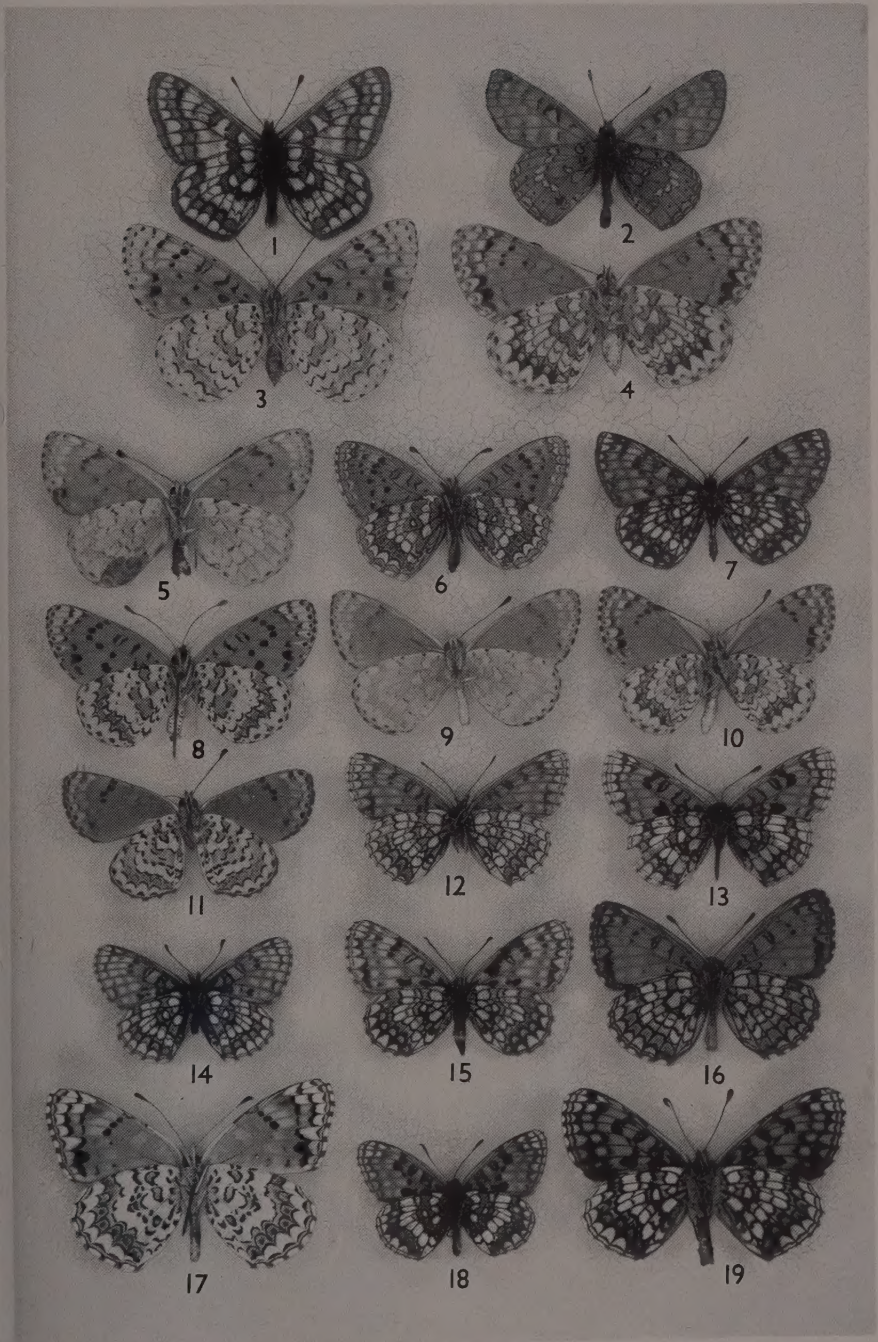
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